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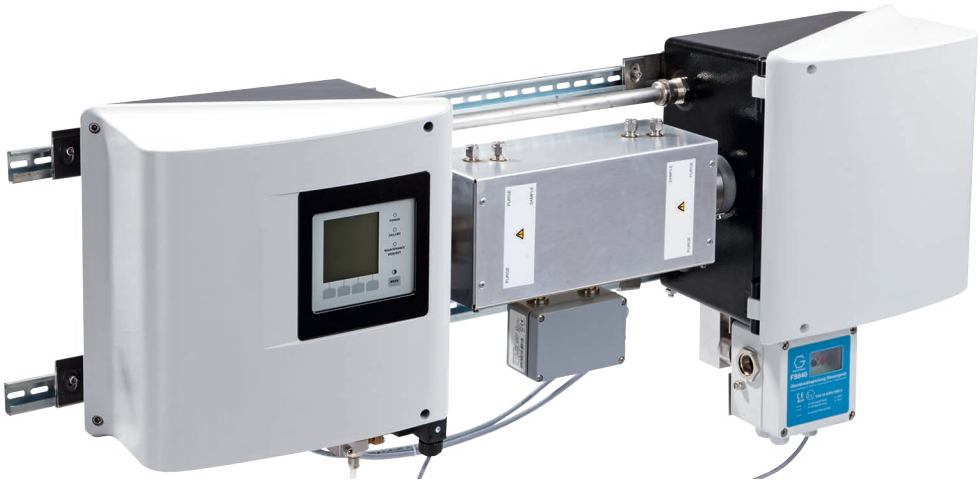
Operating Instructions
MCS300P Ex

Multi-Component Analysis System



Endress+Hauser
People for Process Automation

Described product
Product name: MCS300P Ex

Manufacturer
Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

Production location
Endress+Hauser SICK GmbH+Co. KG
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Legal information

Original document
This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

1 About this document

1.1 Function of this document

These Operating Instructions contain information required for the safe and intended use of MCS300P Ex. They describe:

- Device components
- Mounting and electrical installation
- Commissioning
- Operation
- Maintenance work required for safe operation
- Troubleshooting
- Decommissioning

1.2 Scope of application

These Operating Instructions are exclusively valid for the variants of MCS300P Ex described in the Product identification, see “Product identification”, page 16. These Operating Instructions are not applicable for other measuring devices from Endress+Hauser.

▶ The standards mentioned in the Operating Instructions must be observed in their currently valid version.

1.3 Target groups

These Operating Instructions are intended for skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

- For applications in potentially explosive atmospheres or when measuring flammable and occasionally explosive measured media, qualified personnel are also required, see “Requirements for personnel qualification”, page 14.

1.4 Further information

▶ Observe the supplied documents.

Additional instructions

The following documents are applicable in addition to these Operating Instructions:

- Operating Instructions of the cell used
- Operating Instructions Liquid Preheater (optional)
- “Modular I/O System” Operating Instructions
- *For MCS300P Ex for ATEX/IECEx category 2G / Gb:*
  - F850S Pressurized Enclosure System Manual
  - Ex Relay SR852 (interface relay) Manual
  - Ex Relay SR853 (power relay) Manual
- *For MCS300P Ex for ATEX/IECEx category 3G / Gc:*
  - FS840 Pressurized Enclosure System Manual
  - Optional: Ex Relay SR853 (power relay, optional) Manual

System Documentation

Some parameter settings, components and characteristics depend on the individual device configuration. The delivery state is documented in the System Documentation provided.

The individual characteristics include for example:

- Measured components and measuring ranges
- Additional equipment (options)
- Basic settings

1.5 Symbols and document conventions

1.5.1 Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard by voltage
	Hazard by toxic substances
	Hazard in potentially explosive atmospheres
	Hazard by explosive substances/mixtures
	Hazard by noxious substances
	Hazard by high temperature or hot surfaces

1.5.2 Warning levels and signal words

DANGER: Risk or hazardous situation which *will* result in severe personal injury or death.
WARNING: Risk or hazardous situation which *could* result in severe personal injury or death.
CAUTION: Hazard or unsafe practice which *could* result in less severe or minor injuries.
NOTICE: Hazard which *could* result in property damage.
NOTE: Tips

1.5.3 Information symbols

Symbol	Significance
	Information on product condition with regard to explosion protection
	Important technical information for this product
	Important information on electrical or electronic functions

1.6 Responsibility of user

Designated users

The MCS300P Ex should only be installed and operated by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Correct use

These Operating Instructions presume that the MCS300P Ex has been delivered as specified during project planning and with the relevant delivery state of the MCS300P Ex (→ delivered System Documentation).

- ▶ If you are not sure whether the MCS300P Ex complies with the planned configuration or the delivered System Documentation:
  Please contact Endress+Hauser Customer Service.

- ▶ Use the device only as described in these Operating Instructions.
  The manufacturer assumes no responsibility for any other use.
- ▶ Perform the specified maintenance work.
- ▶ Do not remove, add or modify any components to or on the device unless described and specified in the official manufacturer information. Otherwise:
  - Any warranty by the manufacturer becomes void
  - The device could become dangerous.

Special local requirements

- ▶ In addition to these Operating Instructions, follow all local laws, technical rules and company-internal operating directives applicable at the respective installation location of the device.

Keeping documents

These Operating Instructions:

- ▶ Must be kept available for reference.
- ▶ Must be passed on to new owners.

2 For your safety

2.1 Basic safety information

- ▶ Read and observe these Operating Instructions.
- ▶ Observe all safety instructions.
- ▶ If there is something you do not understand: Contact Endress+Hauser Customer Service.

Correct project planning

These Operating Instructions presume that the device has been delivered as specified during project planning and with the relevant delivery state of the measuring device, see delivered System Documentation.

Contact Endress+Hauser Customer Service if you are not sure whether the device corresponds to the state defined during project planning or to the delivered System Documentation.

Correct use

- Use the device only as described in “Intended use”, see “Intended use”, page 13. The manufacturer bears no responsibility for any other use.
- Perform the specified maintenance work.
- Do not carry out any work or repairs on the device not described in this Manual.
- Do not remove, add or modify any components to or on the device unless described and specified in the official manufacturer information.
- Use only original spare parts and wear and tear parts from Endress+Hauser.

If you do not observe this:

- The manufacturer's warranty becomes void.
- The device could become dangerous.
- The device no longer complies with the approval for the hazardous area.

2.1.1 Explosion protection

Risk of explosion due to improper execution of the work described in these Operating Instructions.

Improper execution of work in the potentially explosive atmosphere can cause serious damage to people and the plant.

- ▶ Maintenance and commissioning tasks as well as tests should only be carried out by experienced/trained personnel with knowledge of the rules and regulations for potentially explosive atmospheres, especially:
  - Ignition protection types
  - Installation rules
  - Zone classification

Risk of explosion due to leaking flammable measured media!

A damaged, leaking cell lets measured media escape. This can result in severe or fatal injuries.

- ▶ Do not subject the cell to excessive mechanical stress.
- ▶ Do not drop the cell and protect it from impacts.

Explosive atmosphere

Danger of explosions. Serious injuries or death.

2.1.2 Dangerous substances

Danger through leaks in the measured medium path when using toxic media

A leak, for example in the purge gas supply, can be an acute hazard for persons.

- ▶ Regularly check all components carrying measured medium for leaks.
- ▶ Implement appropriate safety measures, such as:
  - ▶ Marking the measuring device with warning signs.
  - ▶ Marking the operating area with warning signs.
  - ▶ Adequately venting the operating area.
  - ▶ Safety-oriented instruction of persons who could be in this area.

Hazard by acidic condensate (in gas applications)

Health hazard due to toxic compounds in the condensate.

- ▶ Observe all safety regulations for the application.
- ▶ Take appropriate protective measures for work (e.g., by wearing a safety mask, protective gloves and acid resistant clothes).

In case of contact with the skin or eyes, rinse the affected parts immediately with clear water and consult a doctor.

Hazard resulting from substances remaining in the cell or in the device

Depending on the composition of the measured medium, toxic or corrosive measured media can remain in the device, cell and connected pipes when the measured medium supply is switched off.

- ▶ Purge the device, cell and connected pipes for a sufficient period of time with inert gas (e.g.: N_2).
- ▶ Take suitable protective measures (e.g. work under a vent, wear suitable protective clothes).

2.2 Warning information on the device

The following safety symbols are located on the enclosure:

Symbol	Significance
	Warning of general hazard.
	Warning of hazard through hot surfaces.
	Warning of hazard through voltage.

If you work on an assembly marked with such a symbol:

- Read the relevant Section in these Operating Instructions.

Observe all the safety information in the relevant Section.

2.3 Intended use

2.3.1 Purpose of the device

The MCS300P Ex measuring equipment serves for process monitoring of gases and liquids and for raw gas monitoring in combustion plants.

The measured medium is extracted at a sampling point and led through the cell of the MCS300P Ex (extractive measurement).

2.3.2 Installation location

The MCS300P Ex is intended for indoor operation.

2.4 Operation in potentially explosive atmospheres

The MCS300P Ex is suitable for use in potentially explosive atmospheres and/or for combustible and occasionally explosive measured media. The MCS300P Ex may only be used according to the conditions described in these Operating Instructions.

2.4.1 Ex identification

The Ex identification is located on the type plate of the MCS300P Ex. Check the type plate before use in potentially explosive areas or when using combustible measured media.

ATEX

The MCS300P Ex meets the following qualifications in accordance with the ATEX Directive:

- Ⓔx II 2G Ex eb pxb IIC T4 Gb *or.*
- Ⓔx II 2G Ex eb pxb IIC T3 Gb

or

- Ⓔx II 3G Ex eb pzc IIC T4 Gc *or*
- Ⓔx II 3G Ex eb pzc IIC T3 Gc

IECEx

The MCS300P Ex meets the following qualifications in accordance with IECEx:

- Ex eb pxb IIC T4 Gb *or*
- Ex eb pxb IIC T3 Gb

or

- Ex eb pzc IIC T4 Gc *or*
- Ex eb pzc IIC T3 Gc

2.4.2 Certificates

EU Type Examination Certificate

- BVS 10 ATEX E 133 X
- BVS 10 ATEX E 134 X

IECEx Certificate

- IECEx BVS 17.0059X

2.4.3 Application conditions

- A measuring function for explosion protection is not part of the type approval.
- The overpressure monitoring setting must match the parameters, see “Pressurized enclosure system settings for ATEX-2G”, page 85 or see “Pressurized enclosure system settings for ATEX-3G”, page 86.
- Do not remove, add or modify any components to or on the device unless described and specified in the official manufacturer information. Otherwise the approval for use in potentially explosive atmospheres becomes void.
- Adhere to the prescribed maintenance intervals (see “Maintenance plan”, page 59).
- When using the MCS300P Ex in potentially explosive atmospheres: Use only an Endress+Hauser Ex cell with suitable ATEX category and suitable temperature class.
- Only use the MCS300P Ex with a fault current or isolation monitoring system. Use a residual current device with a rated operating residual current of 30 mA (supply of connected heaters).
- The cable glands and plugs belong to the certification. Do not replace cable glands or plugs with other types.
- The MCS300P Ex has a pressurized enclosure system which prevents the formation of an explosive atmosphere in the enclosure. For information on how the pressurized enclosure system functions and the assemblies used, see “Function of the pressurized enclosure”, page 19.

2.4.4 Internal temperature monitor

The MCS300P Ex has monitor devices for both internal temperature controllers.

Depending on the temperature class, there is a maximum temperature of (T_{max}) at which the temperature monitor triggers and switches the heater off.

Tolerances can cause the temperature monitoring to trigger at a temperature slightly lower than T_{max}.

Observe the maximum nominal temperature:

Temperature class	T_{max}	Maximum nominal temperature
T4	130 °C (266 °F)	118 °C (244 °F)
T3	150 °C (302 °F)	137 °C (278 °F)

2.4.5 Combustible measured media

When used with an appropriate Endress+Hauser Ex cell and an optional liquid preheater, the MCS300P Ex is capable of measuring combustible and occasionally explosive measured media (corresponding to Zone 1).

2.5 Requirements for personnel qualification

Installation, commissioning, maintenance, inspection and repair in potentially explosive atmospheres may only be carried out by skilled/trained persons having knowledge of the relevant rules and regulations for potentially explosive atmospheres, especially:

- Ignition protection types
- Installation rules
- Zone classification

Applicable standards (examples):

- IEC 60079-14, Annex F: Knowledge, skills and competencies of responsible persons, operatives and designers
- IEC 60079-17: Electrical installations inspection and maintenance
- IEC 60079-19: Device repair, overhaul and reclamation

Connections for measured media may only be made by qualified personnel who are familiar with working with pipes and pipe fittings and are capable of performing an appropriate leak test.

Maintenance work on the MCS300P Ex may only be carried out by skilled persons trained on the MCS300P Ex.

3 Product description

3.1 Product identification

Product name:	MCS300P Ex
Manufacturer:	Endress+Hauser SICK GmbH+Co. KG Bergener Ring 27 · D-01458 Ottendorf-Okrilla · Germany
Production location:	Endress+Hauser SICK GmbH+Co. KG Rengoldshauser Str. 17a · D-88662 Überlingen · Germany

Type plate

Observe the Ex marking on the type plate. The type plate is located on the sender unit of the MCS300P Ex.

Fig. 1: Example: Type plate 2G

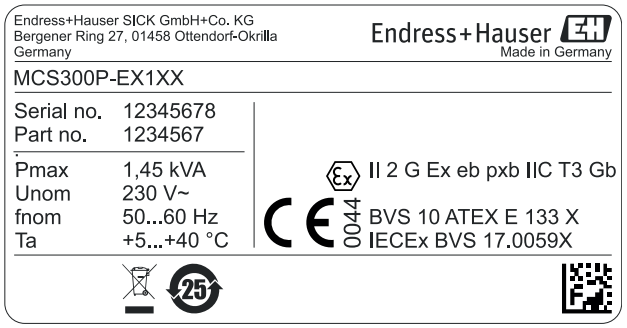
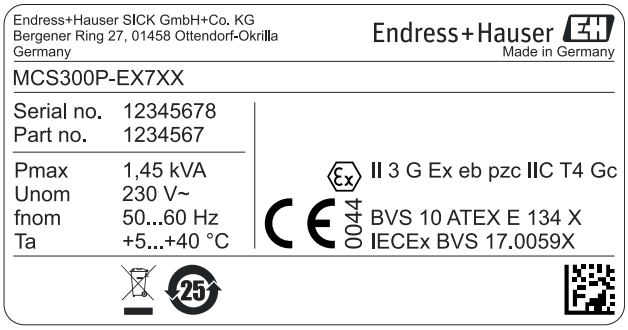


Fig. 2: Example: Type plate 3G



3.2 Features of the MCS300P Ex

NOTE:
The MCS300P Ex has customized equipment.
▶ For the equipment fitted on your MCS300P Ex, see the System Documentation provided.

Fig. 3: MCS300P Ex category 3G with pressurized enclosure system

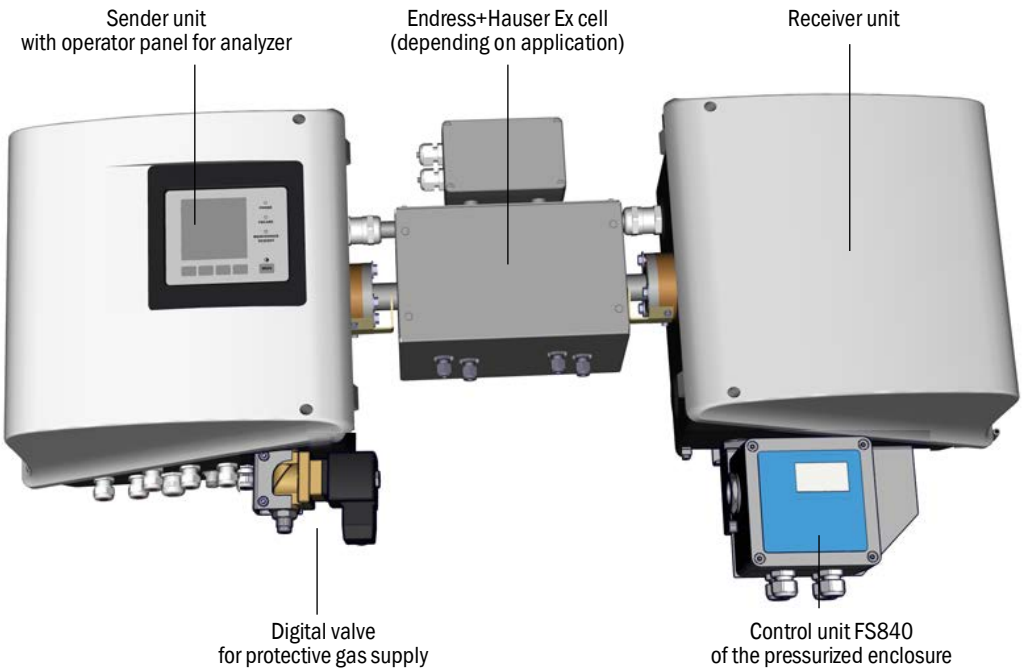
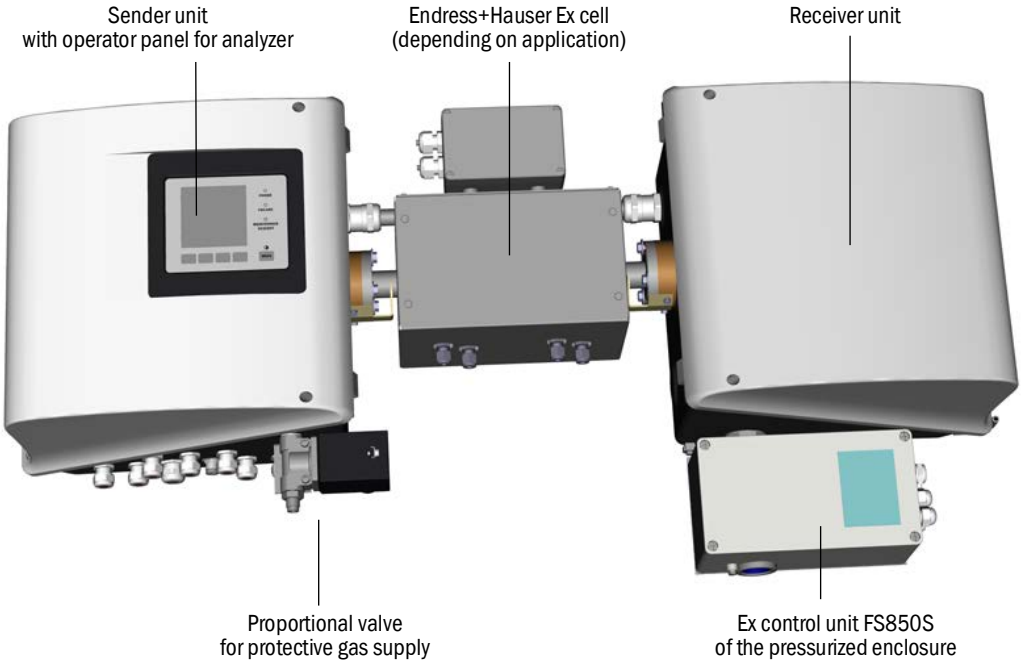


Fig. 4: MCS300P Ex category 2G with pressurized enclosure system



Function

The MCS300P Ex serves for process monitoring of gases and liquids as well as for raw gas monitoring in combustion plants.

The measured medium is extracted at a sampling point and led through the cell of the MCS300P Ex (extractive measurement).

Photometer

Spectral acquisition of measured media concentrations: Non-dispersive photometer with interference and optional gas filters.

Measured media components and measured values

Number of measured media components: 6 simultaneously.

Correction of cross-sensitivity values: Max. 6.

Internal computation of measured values (depending on parameter settings): Cross-sensitivity compensation, scaling (pressure, temperature), conversion to “dry flue gas”.

Measuring range switch-over and measuring points

Number of measuring ranges: 2 measuring ranges per component.

Number of measuring points: Max. 8.

Cells

The intended cell has been fitted and, if applicable, the optional liquid preheater mounted according to the preceding project planning (→ System Documentation provided).

External signals and sensors

External analog and digital signals can be read in.

Measured media pressure and measured media temperature can be recorded using external sensors and these signals passed to the MCS300P Ex and processed there.

3.2.1 Function of the pressurized enclosure

3.2.1.1 *Purpose*

The pressurized enclosure prevents an explosive atmosphere from being created inside the enclosure. To this purpose, the analyzer enclosure is filled with a protective gas. Apart from that, this also ensures the measured media pressure inside the analyzer enclosure is higher than the ambient air pressure.

3.2.1.2 *Functionality during operation*

The pressurized enclosure system functions in “leakage compensation” operating mode: A protective gas pressure is created in the analyzer enclosure after pre-purging has completed. If the protective gas pressure drops below the minimum pressure set, protective gas feed is activated until the rated pressure is reached again.

3.2.2 Safety functions

For MCS300P Ex category 2G

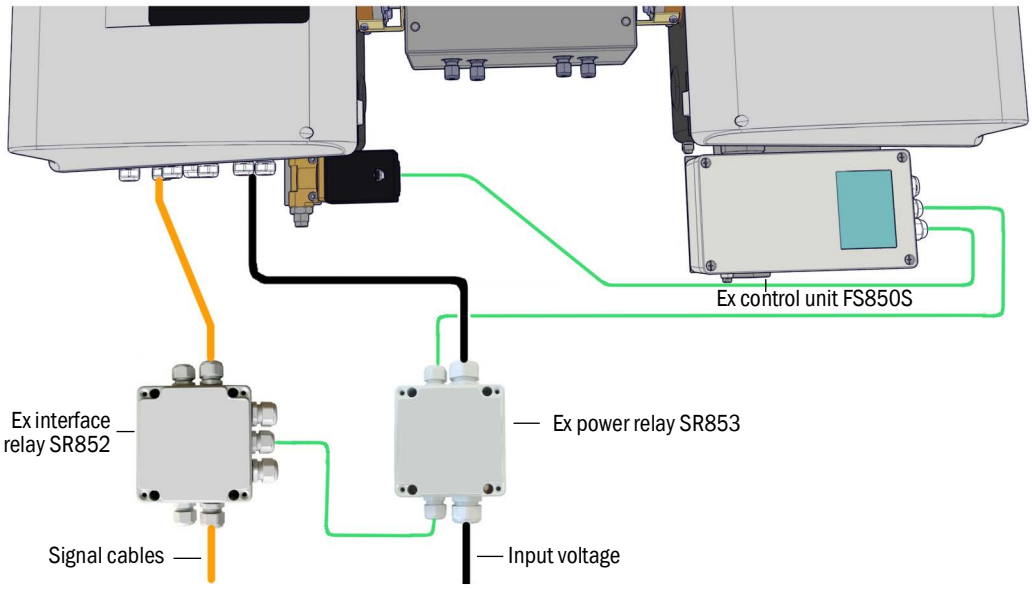
- The enclosure is pre-purged automatically during commissioning. The power supply and signal transmission of the analyzer are switched on automatically afterwards.
- The power supply and signal transmission of the analyzer are switched off automatically when the pressurized enclosure is not in the correct operating state (malfunction).

For MCS300P Ex category 3G

The Ex control unit FS840 creates an alarm signal which must be evaluated when the pressurized enclosure is not in the correct operating mode (malfunction) (responsibility of operator, → FS840 Pressurized Enclosure Manual).

3.2.2.1 *Assemblies used*

Fig. 5: Ex peripherals for MCS300P Ex category 2G



Ex control unit FS850S (for MCS300P Ex category 2G)

Ex control unit FS850S switches the main power supply of the MCS300P Ex and the Ex interface relays on and off.

- ON: After the pre-purge phase has ended.
- OFF: When the pressurized enclosure is not in the correct operating state (malfunction).

The Ex power relay controls the power supply of the MCS300P Ex (see “Ex peripherals for MCS300P Ex category 2G”, page 19).

Ex control unit FS840 (for MCS300P Ex category 3G)

Ex control unit FS840 triggers an alarm signal when the pressurized enclosure is not in the correct operating state (malfunction).

Ex power relay SR853 (for MCS300P Ex category 2G)

Ex power relay SR853 (optional for MCS300P Ex category 3G) serves to separate the non-intrinsically safe power supply of the MCS300P Ex.

Ex interface relay SR852 (for MCS300P Ex category 2G)

Ex interface relay SR852 serves to separate the non-intrinsically safe signal cables (data cables).

NOTE:
The number of required interface relays depends on the individual application.
▶ Observe the System Documentation provided.

3.3 Method of operation

Operating states

The actual operating state is displayed on the operator panel and output via status signals.

Error messages are shown on the display and recorded in a logbook (SOPAS ET).

NOTE:
For more information concerning the operating states, see “Status and classification”, page 41.

Sequence control programs

Various sequence control programs can be started via the operator panel.

Typical sequence control programs (depending on parameter settings) are:

- Adjustment with test medium
- Adjustment with internal adjustment standard (optical filter, option)

NOTE:
For the parameterized sequence control programs, see the System Documentation provided.

3.4 Interfaces

- Analog and digital interfaces (depending on equipment)
- Ethernet (depending on individual version)

3.5 SOPAS ET (PC program)

SOPAS ET can be used to set the MCS300P Ex parameters and provides access to the MCS300P Ex logbook.

SOPAS ET runs on an external computer connected to the MCS300P Ex via the Ethernet interface.

4 Mounting

4.1 Safety

Before working on the MCS300P Ex in potentially explosive atmospheres or when using combustible or occasionally explosive measured media, observe the general safety requirements, application conditions and personnel requirements, see “Operation in potentially explosive atmospheres”, page 13.

WARNING: Health risk through dangerous measured medium
The modules and devices contain enclosed, potentially dangerous measured media that can escape should a defect or leak occur.
The operator is responsible for the safe handling of the measured medium.
- In addition to these Operating Instructions, follow all local laws, technical rules and company-internal operating directives applicable at the respective installation location of the MCS300P Ex.
- Operate the MCS300P Ex only in adequately ventilated rooms
  OR
  install a suitable measured media monitor.
- Feed and drain the measured medium in a safe manner.
- Regularly check the state of the device/module seals.
- Only open the device when well ventilated, especially when a leak of a device component is suspected.

The description of the installation presumes that the MCS300P Ex has been delivered as specified during project planning and with the relevant delivery state of the MCS300P Ex (→ delivered System Documentation).
- If you are not sure whether the MCS300P Ex complies with the planned configuration or the delivered System Documentation:
  Please contact Endress+Hauser Customer Service.
- If you intend to make changes to the MCS300P Ex:
  Please contact Endress+Hauser Customer Service.

The operator is responsible for:
- Determining and preparing the measuring point (e.g., determining a representative measuring point).
- Feeding and discharging the measured medium.
- Feeding and discharging the protective gas.
- The supply of zero gas and test media.

CAUTION: Risk of injury through incorrect lifting and carrying the device

Injuries can occur due to the weight and projecting enclosure parts when the device tips over or drops. Observe the following information to avoid such accidents:

- Do not use protruding parts on the enclosure to carry the device (apart from the wall fixture).
- *Never* lift the device using the open device door.
- Consider the device weight before lifting.
- Observe the regulations for protective clothing (e.g., safety shoes, non-slip gloves)
- Grip underneath the device when possible to carry it safely.
- Use a hoist or transport equipment as an option.
- Use the help of a second person when necessary.
- Secure the device during transport.
- Before transporting, ensure obstacles that could cause falls or collisions are cleared away.

CAUTION: Accident risk through inadequate fastening of the device

- Consider the device weight specifications when planning the mounting supports.
- Check the load capacity/condition of the wall/rack on/in which the device is to be mounted.

WARNING: Risk of explosion with a cell not suitable for Ex zones

- When using the MCS300P Ex in potentially explosive atmospheres:
  Only use an Endress+Hauser Ex cell and possibly an optional liquid preheater with ATEX/IECEx category and suitable temperature class.

4.2 Material required

Mounting material	Part No./reference	Required for
Dowels / screws (M5)	----	Mounting of G-type rails
Hose/tube for measured medium	see Operating Instructions of the cell	Measured medium feed and drain line
Pipes for purge gas	see Operating Instructions of the cell	Purge gas feed and drain line
Pipes for protective gas supply	see “Protective gas”, page 85	Feeding of protective gas

Tool	Part No./reference	Required for
4 mm Allen key	---	Mounting bracket

4.3 Overview of mounting steps

Mounting step	Remark/reference
Determining the installation location	As close as possible to the measuring point. Fitting position according to System Documentation.
Mounting the MCS300P Ex	see “Mounting the MCS300P Ex”, page 24
Mounting the Ex relay	see “Mounting the Ex power relay and Ex interface relay”, page 25
Connecting the measured medium feed and drain lines	see “Connecting the tubes of the measured and test medium”, page 26
Connecting the protective gas	see “ Connecting the protective gas”, page 26

4.4 Mounting the MCS300P Ex

NOTE:

MCS300P ExThe MCS300P Ex can twist when lifted, especially with long cells.

- Use 2 persons to carefully lift the MCS300P Ex.
- Avoid twisting or bending.
- Do not place the MCS300P Ex on the proportional valve and/or control unit.

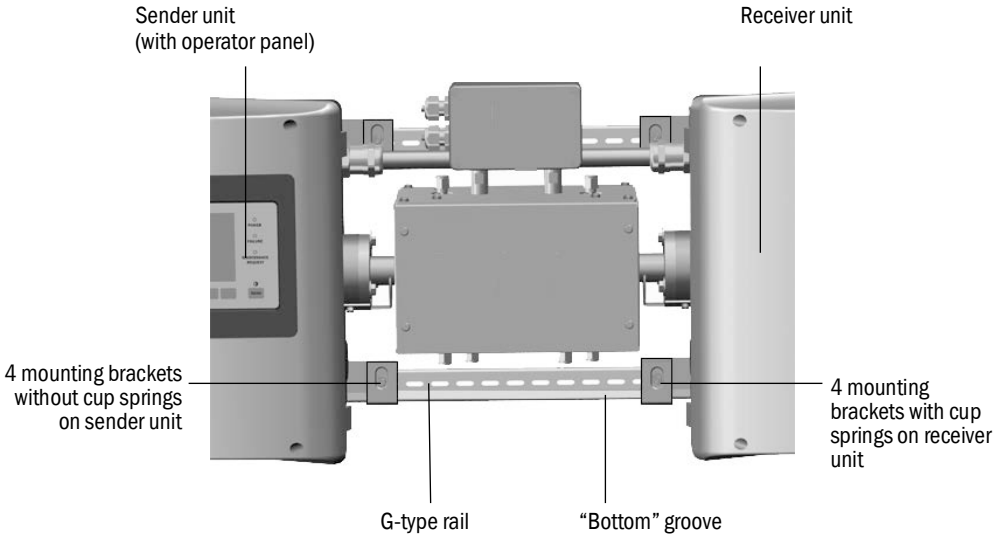
NOTE:

- Mount the MCS300P Ex in the position specified during project planning for the MCS300P Ex.

NOTE:

- The MCS300P Ex must be installed with a clearance of at least 20 cm on all sides.

Fig. 6: Mounting position (example: horizontal mounting)



1 Fasten the G-type rails to the wall or mounting plate (fitting direction and drilling diagram, see “Technical data”, page 79 cont.).
   – Observe the carrying capacity of approx. 30 kg plus cell and liquid preheater (optional).
   – Position groove (see Fig. 6) for mounting the MCS300P Ex at the bottom.
2 Screw the 4 mounting brackets and cup springs loosely on the receiver unit so that enough clearance remains for temperature equalization.

4.5 Mounting the Ex power relay and Ex interface relay

▶ Mount the Ex power relay (SR853) and the Ex interface relay (SR852) near the MCS300P Ex.

NOTE:
→ Ex Power Relay (SR853) Manual and Ex Interface Relay (SR852) Manual.

4.6 Connecting the tubes of the measured and test medium

NOTE:
The operator is responsible for correct connection of the tubes of the measured medium as well as for the supply with zero gas and test media.
Information → Operating Instructions of the connected cell.

4.6.1 Connecting the protective gas

Fig. 7: Protective gas connections for MCS300P Ex category 2G

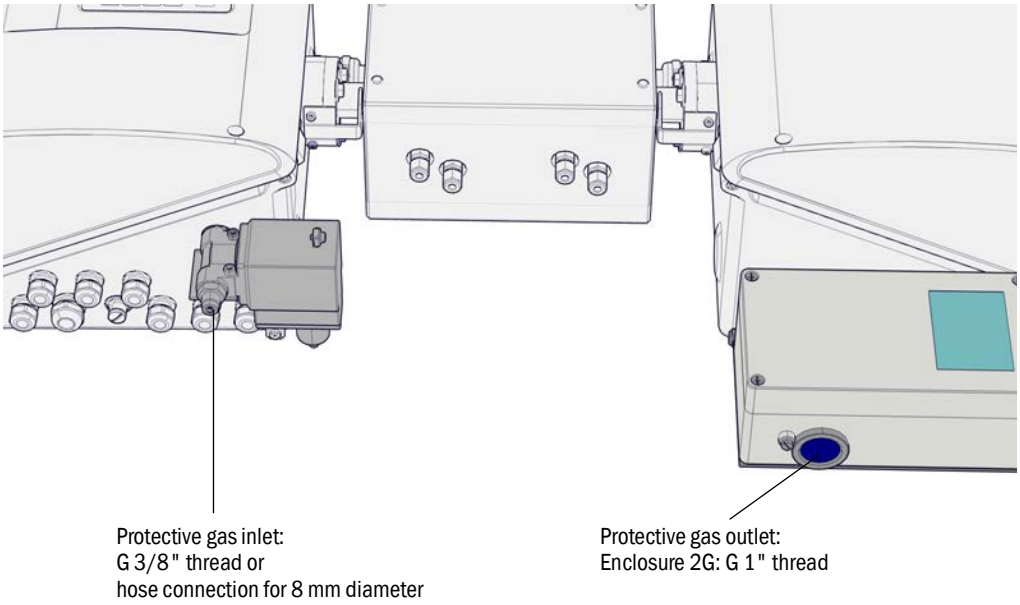
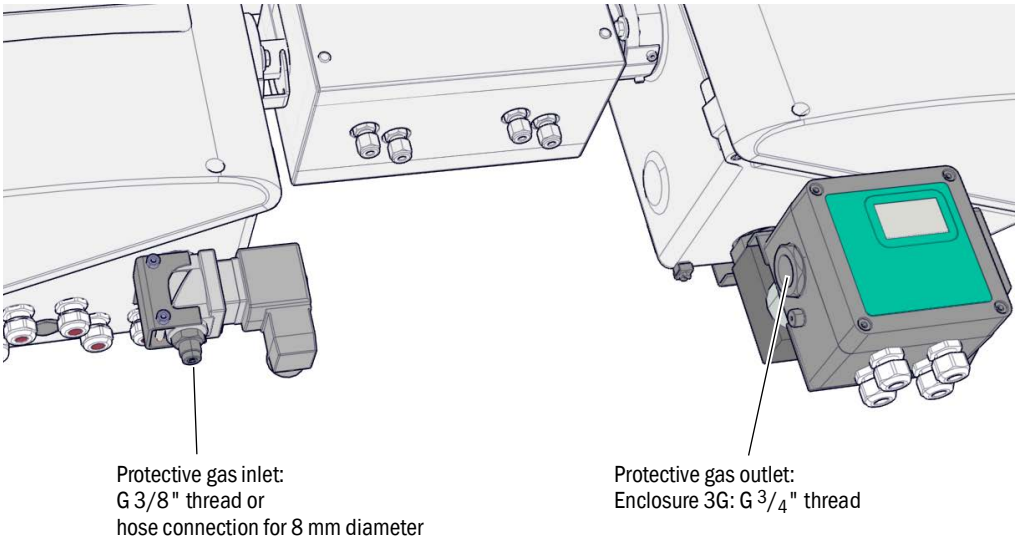


Fig. 8: Protective gas connections for MCS300P Ex category 3G



4.6.2 Feeding protective gas

The pressurized enclosure requires a permanent supply of a protective gas.

- ▶ Feed the protective gas via the protective gas connection (see Fig. 7 and/or see Fig. 8).
- ▶ Requirements for protective gas, see “Protective gas”, page 85

4.6.3 Discharging protective gas

- ▶ Ensure the protective gas can flow out of the protective gas outlet unhindered, i.e., against atmospheric pressure.

5 Electrical installation

5.1 Safety

Before working on the MCS300P Ex in potentially explosive atmospheres or when using combustible or occasionally explosive measured media, observe the general safety requirements, application conditions and personnel requirements, see “Operation in potentially explosive atmospheres”, page 13.

WARNING: Hazards through electric voltages

- Only let the work described in the following be carried out by skilled electricians who can recognize potential risks.
- Before opening the enclosure: Disconnect all MCS300P Ex poles from the power supply.

NOTICE: Screwing cable glands gas-tight

- Only use cables (according to IEC 60079-14) with suitable outer diameters (see “Horizontal mounting shownt”, page 79).
- Close off cable glands “vapor-proof” (virtually gas-tight).
- Only open those cable glands to be used for cable installation.
- Keep the plugs. Refit the original plug when a cable gland must be closed again afterwards.

The cable glands and plugs belong to the certification.

- Do not replace cable glands or plugs with other types.

NOTE: Observe the System Documentation during installation

- Observe the terminal assignment (→ System Documentation).

NOTICE: Device damage through incorrect or missing grounding

During installation and maintenance work, it must be ensured that the protective grounding to the devices and/or cables involved is effective in accordance with EN 61010-1.

5.2 Material required

Mounting material	Part No./reference	Required for
El. supply cable	see “Preparing the power supply”, page 32	Analyzer power connection
El. cables for signals	---	Connection of signal cables

Tool	Part No./reference	Required for
5 mm Allen key	---	MCS300P Ex cover

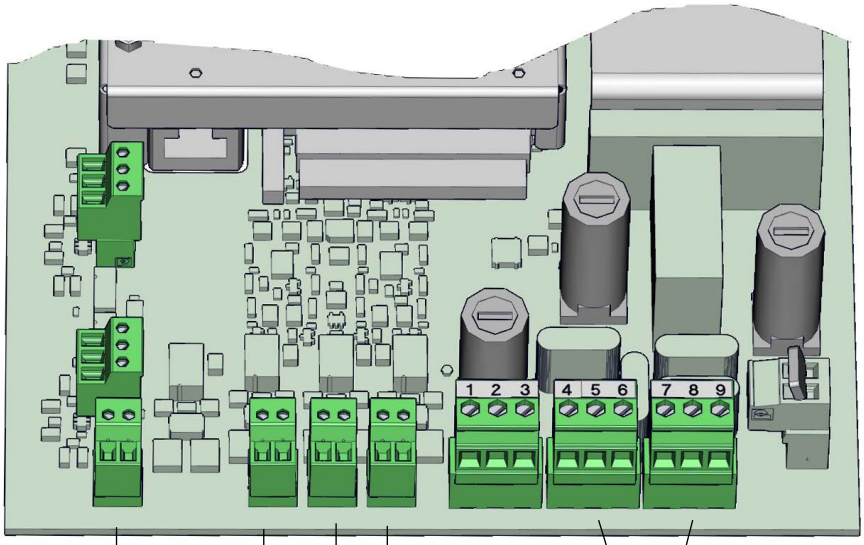
5.3 Overview of mounting steps

Mounting step	Remark/reference
Connecting the power supply	see “Preparing the power supply”, page 32
Connecting signal cables	see “Connecting signal cables”, page 30
Connecting Ex peripherals	see “Connecting Ex peripherals (for MCS300P Ex category 3G)”, page 33 or see “Connecting Ex peripherals (for MCS300P Ex category 2G)”, page 34

Mounting step	Remark/reference
Connecting the potential equalization	see “Connecting the potential equalization”, page 35
For the “Modbus” option: Establish a connection via Ethernet.	see “Connecting Ethernet for Modbus”, page 36

5.4 Signal connections in the sender unit

Fig. 9: Electrical connections in the sender unit: Output voltage (see "Preparing the power supply", page 32)



PT100
Temperature monitor 2
Temperature monitor 1 (cell)
Controller 2
Controller 1 (cell)

Heaters Output voltage as input voltage		
Heater	Cable	Pin
Heater 1 (cell)	L1	4
	N	5
	PE	6
Heater 2	L1	7
	N	8
	PE	9

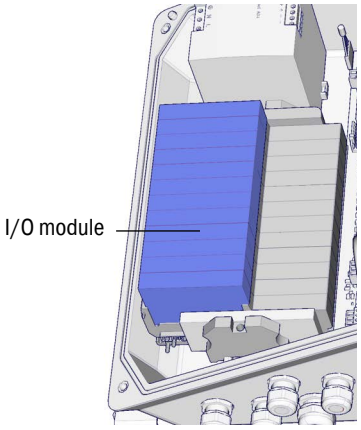
5.4.1 Opening the sender unit

1 Loosen 4 screws (5 mm Allen key).
2 Open the cover.

5.4.2 Connecting signal cables

For *MCS300P Ex* category 2G: Observe information on connecting the Ex interface relays (see "Connecting Ex peripherals (for MCS300P Ex category 2G)", page 34).

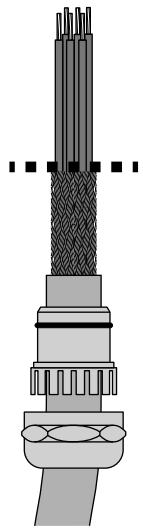
Fig. 10: Position of the I/O interfaces in the sender unit



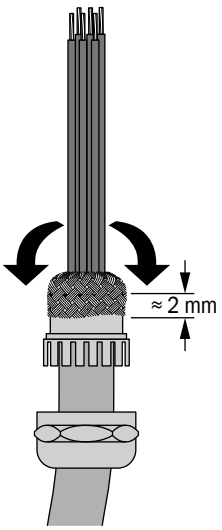
- ▶ Use signal cables with shielding.
- ▶ Lead each signal cable through a cable gland (see Fig. 14, page 34).
- ▶ Create a safe contact between the shield of the signal cable and the cable gland (see Fig. 11).
- ▶ Connect the signal cables to the I/O modules (terminal assignment → System Documentation provided).

NOTE:
Information on the I/O modules → Operating Instructions “Modular I/O System”.

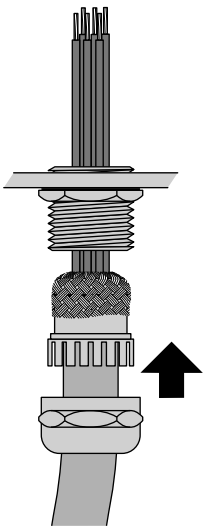
Fig. 11: Handling the cable glands for signal cables



1 Push the screw cap and clamp sleeve of the cable gland onto the signal cable.
2 Uncover and shorten the shield of the signal cable.



3 Push the shielding braid backwards over the clamp sleeve. Make sure the shielding braid overlaps the sealing ring of the clamp sleeve (≈ 2 mm).



4 Insert signal cable + clamp sleeve in the cable gland.
5 Screw the cable gland gas-tight (see page 28).

5.4.3 Connecting thermostatic-controlled assemblies

▶ Route the cables through the cable gland and connect the cables (see “Preparing the power supply”, page 32).

5.4.4 Preparing the power supply

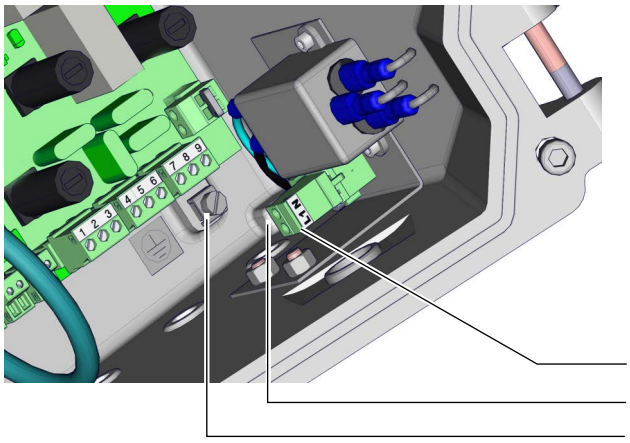
Observe information on connecting the Ex control unit and, when necessary, the Ex power relay (see “Connecting Ex peripherals (for MCS300P Ex category 3G)”, page 33).

▶ Connect the MCS300P Ex only with power supply systems with a residual current and/or insulation monitoring system.
▶ Provide separate external main power switches which can be disconnected on all connectors and fuses in the proximity of the MCS300P Ex (max. power input of the MCS300P Ex → Technical data).
Make sure the disconnector switch is easily accessible.
3 Check the input voltage specified in the System Documentation.

NOTICE: Fuse values are input voltage dependent
If the input voltage available locally is not identical with the input voltage specified in the System Documentation or there are any doubts concerning the input voltage set:
▶ Check the fuse values in the MCS300P Ex (see “Fuses”, page 71).

4 Route the electric cables through the cable gland and connect the cables.

Fig. 12: Connecting the power supply



Power supply	
Fuses are input voltage dependent.	
Cable	Terminal
L1	L1
N	N
PE	G[1]

[1] G = enclosure ground

Shown without protective gas supply

5.4.5 Closing the sender unit

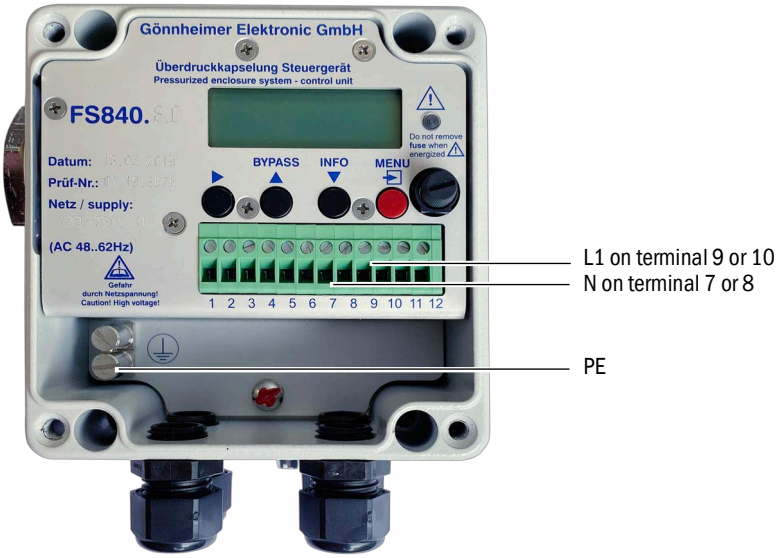
▶ Close the sender unit and screw tight.

5.5 Connecting Ex peripherals (for MCS300P Ex category 3G)

▶ Check the input voltage specified in the System Documentation and on the type plate of the solenoid valve.

5.5.1 Ex control unit FS840 power supply

Fig. 13: FS840 input connection



NOTE:
Further information → FS840 Pressurized Enclosure System Manual

5.5.2 Alarm signal of the pressurized enclosure system

▶ Connect the alarm signal (relay-switching contact) of the pressurized enclosure system as described in the Manual of the pressurized enclosure system and in the System Documentation of the MCS300P Ex.

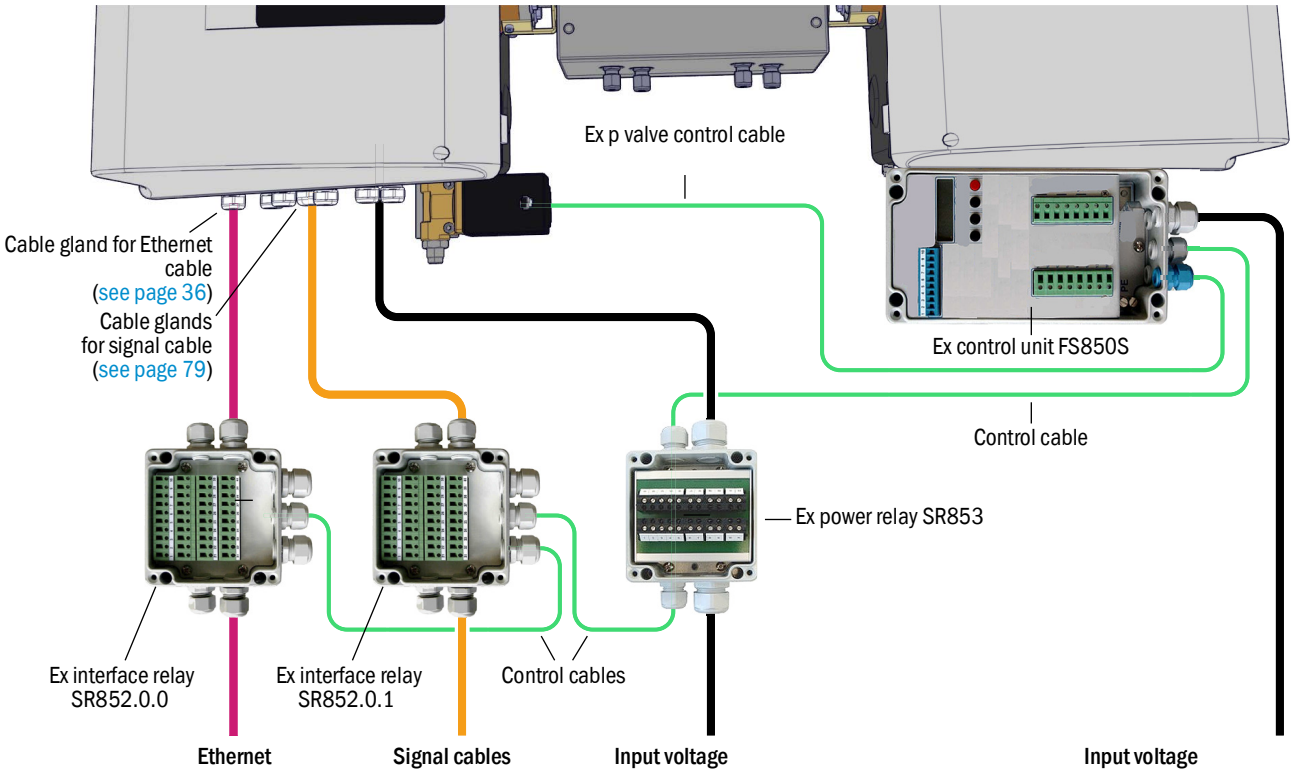
5.5.3 Ex power relay SR853 (option)

Ex power relay SR853 connection, see “Connecting Ex peripherals (for MCS300P Ex category 2G)”, page 34

5.6 Connecting Ex peripherals (for MCS300P Ex category 2G)

All electrical connections must be connected using Ex approved relays.

Fig. 14: Ex peripheral connection for MCS300P Ex category 2G

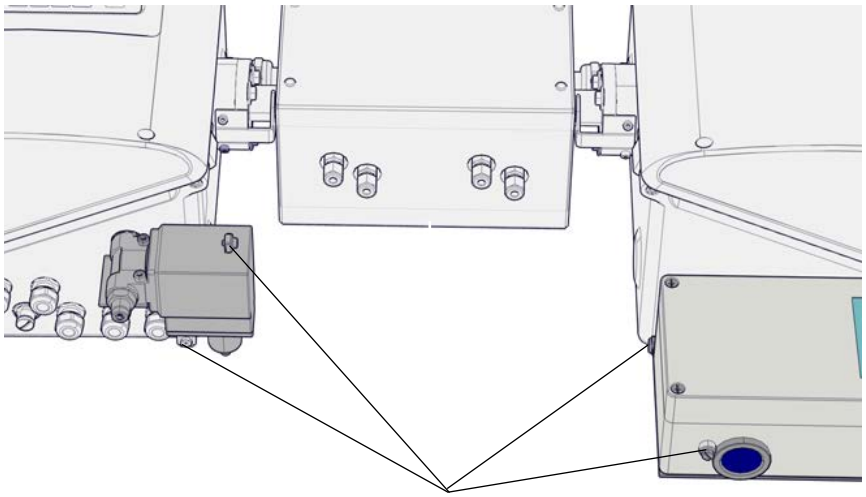


NOTE:
Further information:
→ F850S Pressurized Enclosure System Manual
→ Ex Relay SR852 (interface relay) Manual
→ Ex Relay SR853 (power relay) Manual

5.7 Connecting the potential equalization

▶ Connect 4 potential equalizers (cable: 4 mm^2).
(connect additional potential equalization for cell, Ex interface relay, Ex power relay and liquid preheater (optional)

Fig. 15: Connecting the potential equalization (example using Ex control unit FS850S)



5.8 Connecting Ethernet for Modbus

Applicable only for device versions with "Modbus" option.

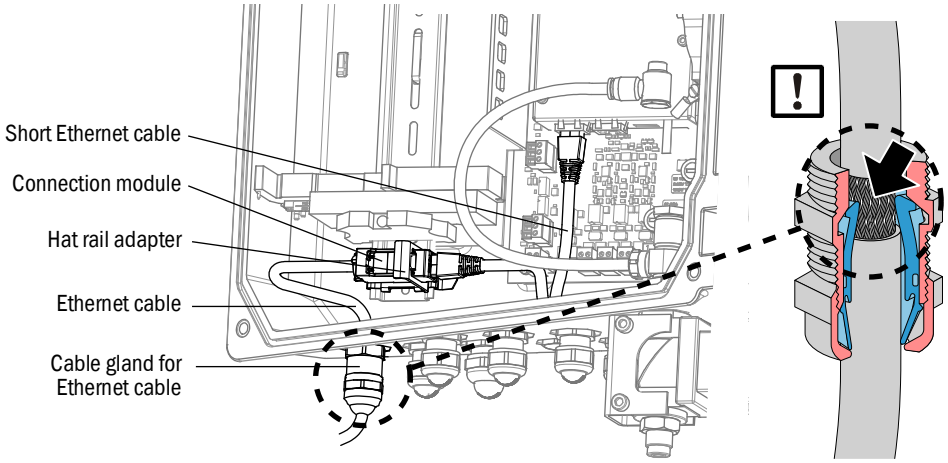
Components

- 1 Ex interface relay
- 2 connection modules for Ethernet (CAT6a, 1 connection module as reserve)
- 1 hat rail adapter (installed in sender unit)
- 1 short Ethernet cable (2x RJ45 for internal connection)

Installation

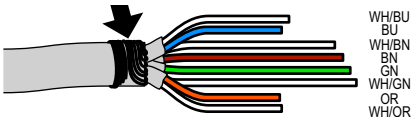
1	*For MCS300P Ex category 2G:* – Install the Ex interface relay. – Route the Ethernet cables via this Ex interface relay. – Observe the regulations and specifications applicable for network connections at the installation location.	see "Connecting Ex peripherals (for MCS300P Ex category 2G)", page 34
2	Route the Ethernet cable through the cable gland for the Ethernet cable into the sender unit. Create a safe contact between the shield of the signal cable and the cable gland: ▶ Uncover the outer shield of the Ethernet cable (approx. 10 mm) in the area of the cable gland. ▶ Insert the Ethernet cable until the uncovered shield has reached the contact position.	see Fig. 16
3	Screw the cable gland gas-tight.	see page 28
4	Connect the Ethernet cable to the connection module.	see "Handling the connection module", page 37
5	Place the finished connection module on the hat rail.	see Fig. 16
6	Connect the connection module and the electronic board with the short Ethernet cable.	

Fig. 16: Ethernet connection

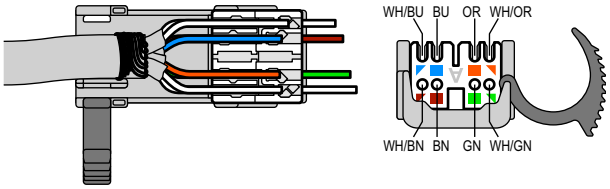


Handling the connection module

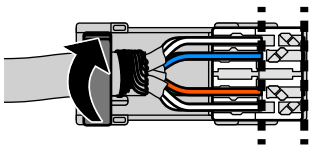
- ▶ Prepare the cable end.



- ▶ Push bottom wires through.
- ▶ Insert top wires.

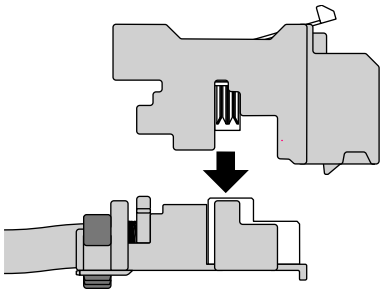


- ▶ Close the strain reliefs.
- ▶ Shorten the wire ends.

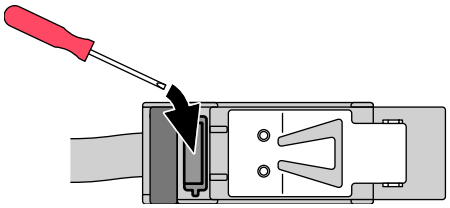


- ▶ Place the top part on the bottom part.

  Press both parts together (use a suitable tool).



- ▶ Press on the shield contact.



6 Commissioning

6.1 Safety

Before working on the MCS300P Ex in potentially explosive atmospheres or when using combustible or occasionally explosive measured media, observe the general safety requirements, application conditions and personnel requirements, see “Operation in potentially explosive atmospheres”, page 13.

6.2 Check before commissioning

- Enclosures are closed (enclosure cover, cable glands, enclosure openings).
- Permanent protective gas feed is ensured (see “Protective gas”, page 85).

NOTE:
Further information on the pressurized enclosure system → see Pressurized Enclosure System Manual delivered with the system.

6.3 Commissioning procedure

Commissioning procedure for MCS300P Ex category 3G

1 Switch the power supply of the pressurized enclosure system on (at an external source).
2 The pressurized enclosure system will start pre-purging the enclosure with protective gas.
The Ex control unit will signal the end of the pre-purge phase.
3 Switch the power supply of the MCS300P Ex on (at an external source).
▶ Continue with Step 4

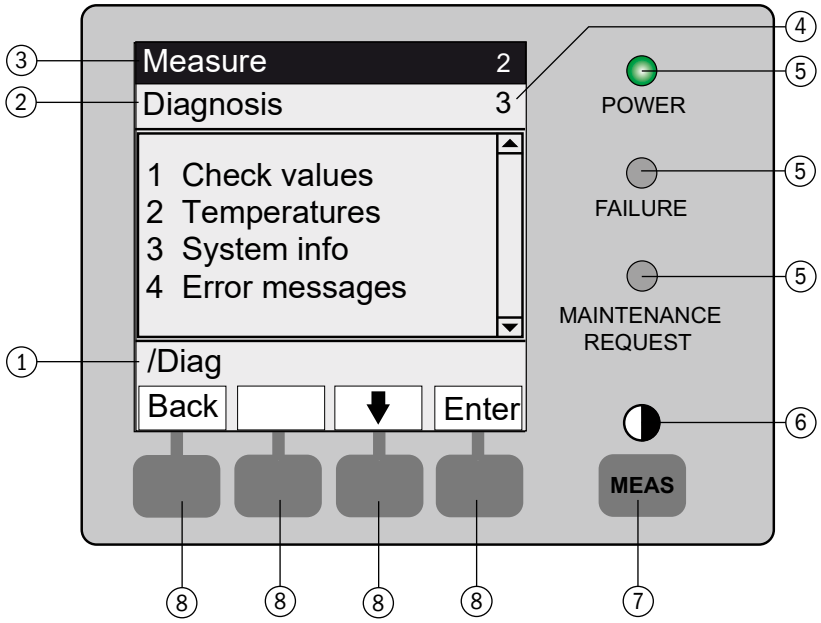
Commissioning procedure for MCS300P Ex category 2G

1 Switch the power supply of the pressurized enclosure system on (at an external source).
2 The pressurized enclosure system will start pre-purging the enclosure with protective gas.
3 The MCS300P Ex will be switched on automatically after a few minutes.
4 The *green* “*POWER*” LED on the MCS300P Ex display will signal that input voltage is present.
5 The logo will appear on the screen.
6 The Measuring screen will then be displayed (see “Display (example: Menu “Diagnosis”)”, page 39).
7 Until the measuring system reaches its measuring operating state (e.g., the operating temperature has not yet been reached):
– Only the green “*POWER*” status LED will light.
– Display will read: “*Status: Heating*”
– Classification “*Uncertain*” (all measured values blink).
8 Measuring operating state reached:
– Only the green “*POWER*” status LED will light.
– Display will read: *“Status: Measuring*” (see “Display (example: Menu “Diagnosis”)”, page 39).
– No measured value blinks (If a measured value blinks: Measured value invalid, see “Malfunction messages”, page 69).
9 Set a new zero point after an adequate run-in phase of the device (min. 4 hours) (see “Adjustment”, page 48).
See also System Documentation.

7 Operation

7.1 Operating and display elements

Fig. 17: Display (example: Menu “Diagnosis”)



1 Current menu branch
2 Current menu
3 Status bar (see “Status (operating state)”, page 41)
4 Menu number
5 LED (see “Classification, LEDs”, page 41)
6 Contrast icon (see “Button assignment”, page 40)
7 “MEAS” button (see “Button assignment”, page 40)
8 Function buttons (see “Button assignment”, page 40)

7.1.1 Button assignment

Table 1

Button	Significance
<MEAS> button	
<MEAS>	Back to the Measuring screen from any menu. – Press <*Save*> to store any changes made. Otherwise the changes are lost. – When the MCS300P Ex is set to *"Maintenance"* (see "Classification, LEDs", page 41): Pressing the <MEAS> button does not affect the "*Maintenance*" state.
	In the Measuring screen: Toggle between list, bar and line representation (see "Measuring screens", page 42).
	◐ To set the contrast: Press the MEAS button for longer than 2 seconds.
Function buttons (menu-dependent buttons)	
<Menu>	Return to the main menu (see "Main menu", page 45). If the <Menu> button is not shown: Press <MEAS> first.
<Back>	Return to the higher level menu. Press <*Save*> to store any changes made. Otherwise the changes are lost.
<Enter>	Open the selected menu.
<Save>	Save changed parameters.
<Start>	Start the displayed action.
<Set>	Set the value.
⇩	Move/scroll downward.
⇧	Move/scroll upward. When numbers are entered: Next higher number.
⇨	Moves to the right in the line.
<Diag>	*Diag* is shown only when there is a message. To display the message: Press this button. More information on diagnosis, see "Diagnosis/error messages and Diag button", page 54. List of error messages, see "Error messages and possible causes", page 73.

7.2 Status and classification

7.2.1 Status (operating state)

The respective operating state (e.g., measuring, heating, etc.) is displayed in the top line of the operator panel.

7.2.2 Classification, LEDs

The classification (error status) is indicated by LEDs on the operator panel and recorded in the logbook (SOPAS ET).

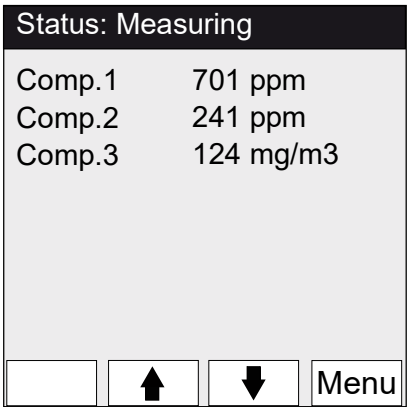
Classification	LED	Significance	Measuring screen	Analog outputs[1]	Status signal[2],[3]
Maintenance		The MCS300P Ex is switched to "*Maintenance*" via the menu or program. The status bar shows: "*Status: Maintenance*"	Actual	Frozen[4]	According to setting
Uncertain		The *uncertain* measured value (e.g., outside calibration range) *blinks*. To view the cause: Press the <*Diag*> button.	Actual	Actual	According to setting
Maintenance request	*Yellow*	Irregularities (e.g., deviation from check cycle too high) that require a review of the cause. To view the cause: Press the <*Diag*> button.	Actual	Actual	According to setting
Failure	*Red*	Device failure (e.g., lamp failed) To view the cause: Press the <*Diag*> button.	Frozen[4]	Frozen[4]	According to setting

[1] Typical default (→ System Documentation).
[2] Option (→ System Documentation).
[3] See SOPAS ET in the "Digital outputs" menu.
[4] The last valid measured value is retained.

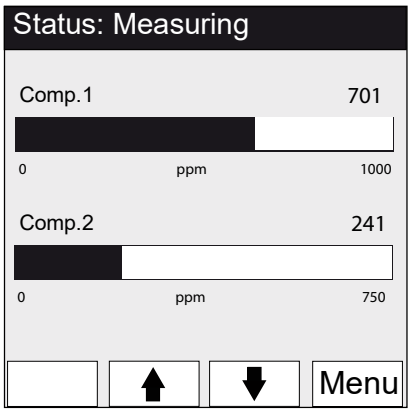
7.3 Measuring screens

Measuring screens:

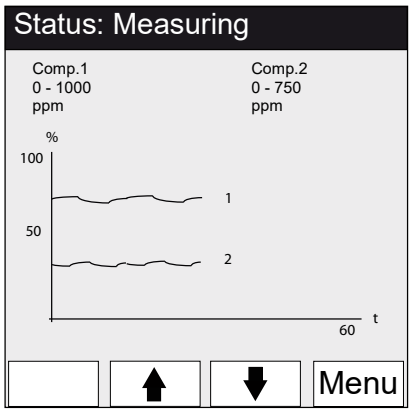
"List" (default)



Bar graph



Line graph



▶ To toggle between the Measuring screens: <*MEAS*> button

7.3.1 "List" Measuring screen

Display of measured values in tabular form.

The "List" Measuring screen is displayed:

- Automatically after the system start
- When the <*MEAS*> button is pressed

Update interval: 1 second (default)

7.3.2 "Bar graph" Measuring screen

Display of 2 measured values each time in bar format.

Update interval: 1 second

▶ Parametrization of display ranges, see "Timeline", page 56

7.3.3 "Line graph" Measuring screen

Display of 2 measured values each time in the time diagram.

The y-axis is always scaled to 0 ... 100% of the display range.

(The respective display range is shown below the component)

Line 1 = left component.

Line 2 = right component.

Update interval:

Time axis [min]	Update interval [sec]
6	4
15	10
30	20
60	40

▶ Parametrization of display ranges, see "Timeline", page 56

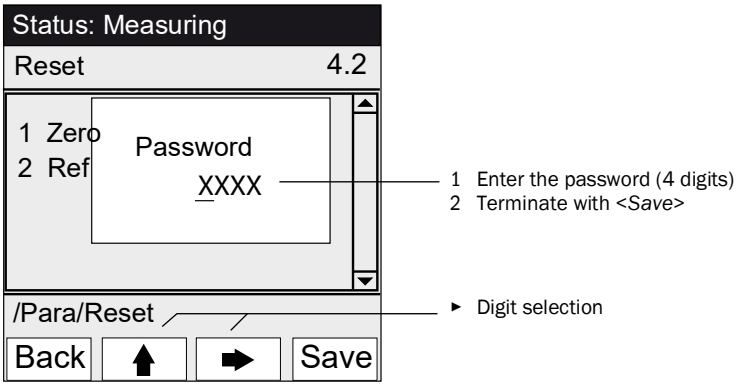
7.3.4 Password

Menus which allow changing the measuring sequence are protected with a password.

The password is prompted automatically when such a menu is called up.

NOTE:
A complete description of the password-protected menus can be found in the MCS300P Ex "Technical Information".

Fig. 18: Password input (example: Reset menu)



- The password contains 4 digits.
- The password is: "*1234*" (default)
- The password level remains valid for 30 minutes (default).

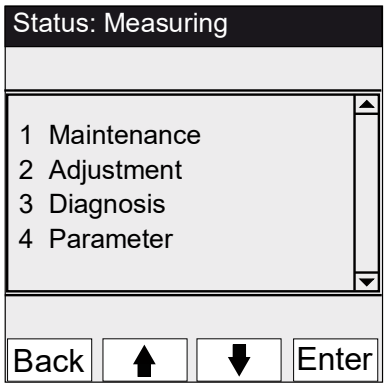
NOTE:
The password and duration of validity can be changed in SOPAS ET.

8 Menus

8.1 Menu tree

Menu No.	Menu tree	Explanation
1	**Maintenance**	see “Maintenance”, page 45
1.1	**Maintenance signal**	
1.2	**Operating states**	
1.2.1	System stop	
1.2.2	Measure	
1.2.3	Initialize	
1.3	**Hardware Reset**	
1.4	**Reset messages**	
2	**Adjustment**	see “Adjustment”, page 48
2.1	**Manual**	
2.1.1	Zero point	
2.1.2	Span point	
2.2	**Automatic**	
2.3	**Parameter**	
2.3.1	Concentration	
2.3.2	Factors	
2.3.3	Start time 1-8	
2.3.4	Start time 9-16	
3	**Diagnosis**	see “Diagnosis”, page 52
3.1	**Check values**	
3.1.1	Zero drift	
3.1.2	Reference energy	
3.1.3	Amplification	
3.1.4	Intensity	
3.2	**Temperatures**	
3.3	**System info**	
3.4	**Error messages**	
4	**Parameter**	see “Parameter”, page 55
4.1	**Display**	
4.1.1	Scale 1 ... 8	
4.1.2	Scale 9 ... 16	
4.1.3	Timeline	
4.2	**Reset**	
4.2.1	Zero drift	
4.2.2	Reference energy	

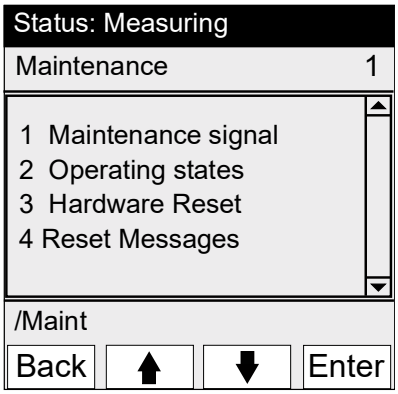
8.2 Main menu



see “Maintenance”, page 45
see “Adjustment”, page 48
see “Diagnosis”, page 52
see “Parameter”, page 55

8.3 Maintenance

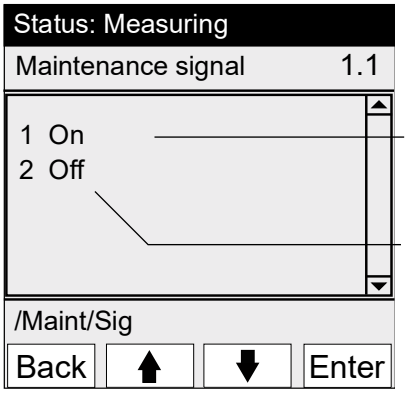
Menu 1: Maintenance



see “Maintenance/maintenance signal”, page 45
see “Maintenance/operating states”, page 46
see “Maintenance/Hardware Reset”, page 47
see “Maintenance/Reset Messages”, page 47

8.3.1 Maintenance/maintenance signal

Menu 1.1: Maintenance/Maintenance sig

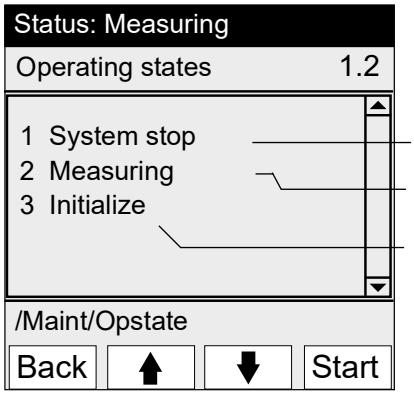


The maintenance signal is set/reset in this menu.

- ▸ The maintenance signal is set. Then:
  - – Classification: “*Maintenance*” (see “Classification, LEDs”, page 41)
  - – Status bar: “*Status: Maintenance*”.
- ▸ The maintenance signal is reset.

8.3.2 Maintenance/operating states

Menu 1.2: Maintenance/Operating states

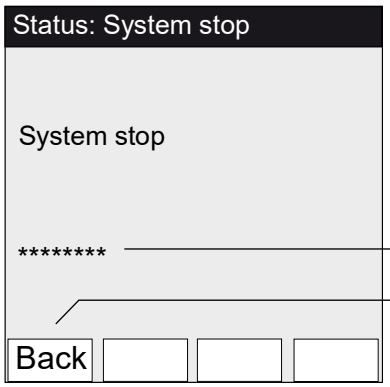


The operating states are switched on in this menu.

- ▸ System stop (see “System stop”)
- ▸ Switch the MCS300P Ex to measuring operation.
- ▸ New start (reset) of the MCS300P Ex.

8.3.2.1 *System stop*

Menu 1.2.1: Maintenance/Operating states/System stop



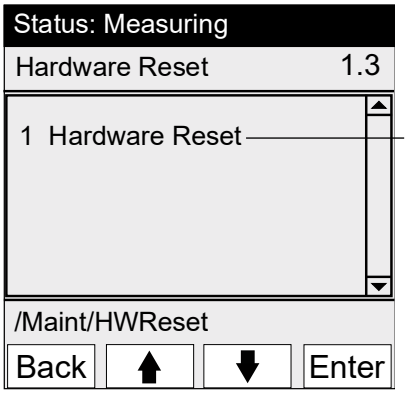
Switch off the measuring function and (if available) the gas sampling peripherals (valves, pumps).
The device function is maintained (e.g., heater operation will continue).
Operating state: *“Maintenance“.*

- • Display: Row of blinking asterisks.

- ▸ To exit the menu: Press the “*Back*” button.
- ▸ Then switch measuring operation on again:
  - Press “*Measuring*”.
  - Switch the maintenance signal off (see “Maintenance/maintenance signal”, page 45).

8.3.3 Maintenance/Hardware Reset

Menu 1.3: Maintenance/Hardware Reset

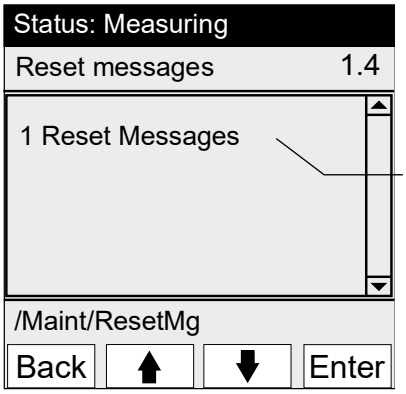


This menu starts a hardware reset (same effect as switching the input voltage off/on).

▸ Start hardware reset.

8.3.4 Maintenance/Reset Messages

Menu 1.4: Maintenance/Reset Messages

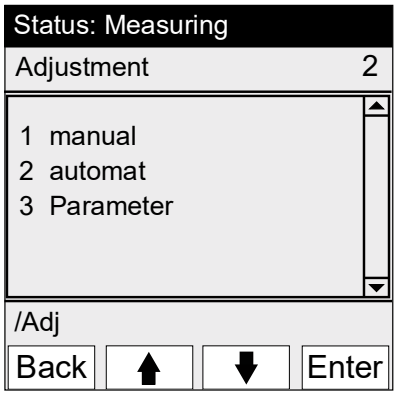


This menu resets all existing error messages.
LED “MAINTENANCE REQUEST” goes off.

▸ Reset error messages.

8.4 Adjustment

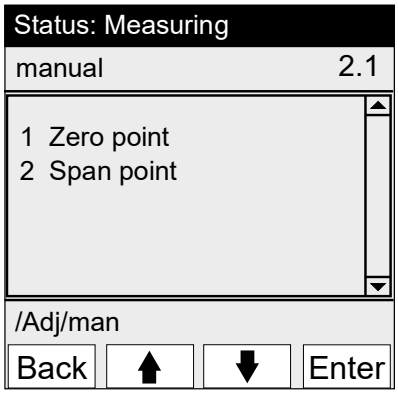
Menu 2: Adjustment



see “Adjustment/manual”, page 48
see “Adjustment/automatic”, page 49
see “Adjustment/Parameter”, page 49

8.4.1 Adjustment/manual

Menu 2.1: Adjustment/manual



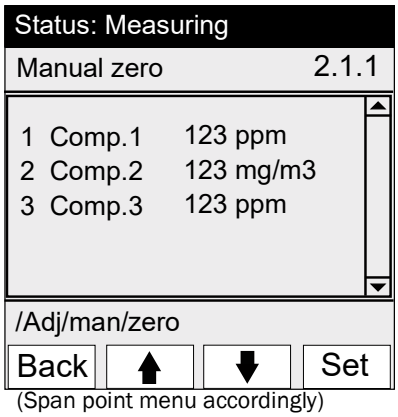
see “Zero point and span point”, page 48
see “Zero point and span point”, page 48

8.4.1.1 *Zero point and span point*

Menu 2.1.1: Adjustment/manual/Zero point

Menu 2.1.2: Adjustment/manual/Span point

Manually adjust zero point and/or span point (recalculate the correction factor) of individual components in this menu item.

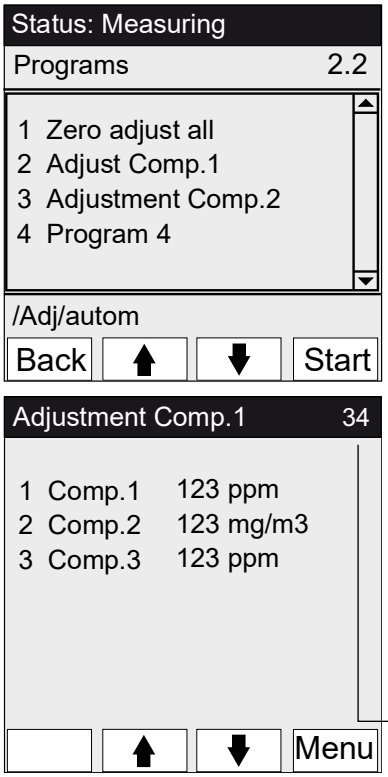


(Span point menu accordingly)

1 Set the maintenance signal (see “Maintenance/maintenance signal”, page 45).
2 Lead the zero and/or reference medium into the cell (“manually”).
3 Wait for the end of the run-in time, (if necessary, exit the menu with “*Back*” to review the run-in behavior in the line graph, see ““Line graph” Measuring screen”, page 43).
4 Select the component.
5 Press “*Set*”: The measured value is set to the nominal concentration. If the deviation is too large (parameter settings → SOPAS ET), the MCS300P Ex switches to classification “*Maintenance request*” (see “Status and classification”, page 41).
6 Press “*Back*” to exit the menu.
7 Reset the maintenance signal.

8.4.2 Adjustment/automatic

Menu 2.2: Adjustment/automatic



Initiate automatic adjustments in this menu item (parameter settings → System Documentation).

The sequences of these programs depend on the parameter settings of the programs (in the Figure: Examples).

For typical programs, status signals are set automatically and valves for the test medium switched automatically.

For devices with internal adjustment standard (see System Documentation): A corresponding program appears.

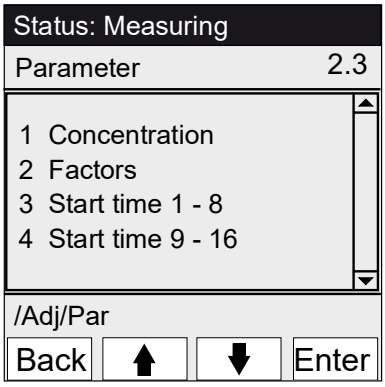
1 To start adjustment: Select the adjustment program and press "*Start*".
2 Operating state: *"Maintenance"*.
3 The Measuring screen is displayed (with a down counter to the end of the adjustment).
4 After the end of the adjustment, the MCS300P Ex switches back to the operating mode "Measuring" (If "*Maintenance*" was previously set manually: Back to "*Maintenance*").

- If the deviation exceeds a limit (parameter settings in SOPAS ET), the MCS300P Ex switches to classification *"Maintenance request"* (see "Status and classification", page 41).

- Down counter to the end of adjustment [seconds].

8.4.3 Adjustment/Parameter

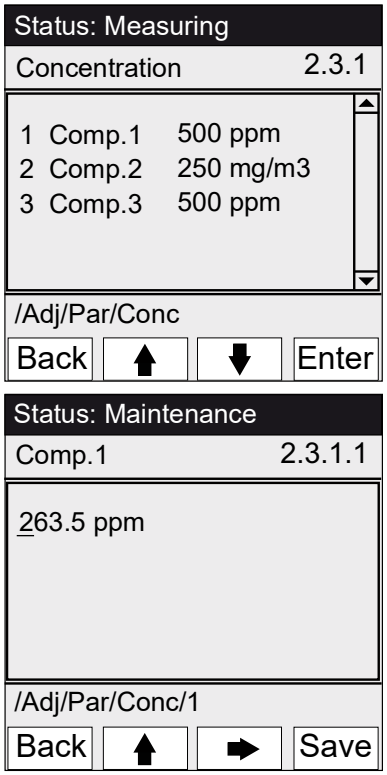
Menu 2.3: Adjustment/Parameter



see "Concentration", page 50
see "Factors", page 51
see "Start times", page 52
see "Start times", page 52

8.4.3.1 *Concentration*

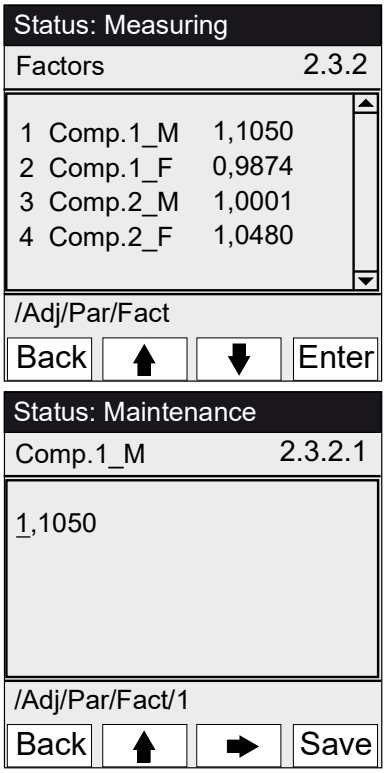
Menu 2.3.1: Adjustment/Parameter/Concentration



Enter the concentrations of the test media within this menu.

8.4.3.2 *Factors*

Menu 2.3.2: Adjustment/Parameter/Factors



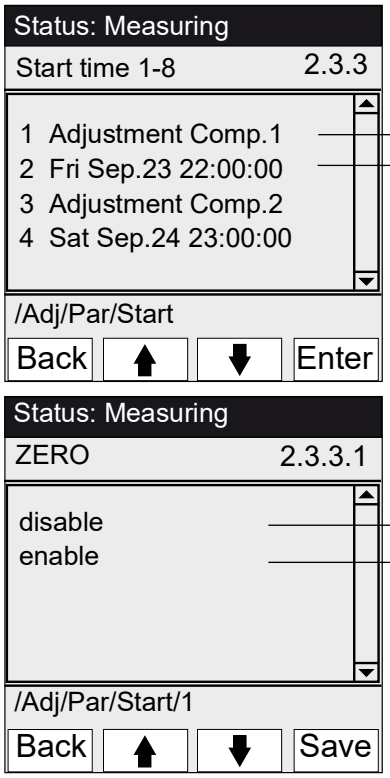
The correction factors of the measured components are displayed and can be manually changed in this menu.

- 2 correction factors exist per component:
  _M: Correction factor for test medium
  _F: Correction factor for internal adjustment standard (internal optical filter) (option).

8.4.3.3 *Start times*

Menu 2.3.3: Adjustment/Parameter/Start time 1 - 8

Menu 2.3.4: Adjustment/Parameter/Start time 9 - 16



In this menu item:

- The respective next start time of a “cyclic trigger” is shown and
- the “cyclic triggers” are disabled or enabled.

Explanation: A “cyclic trigger” can be assigned to sequence control programs (→ SOPAS ET).

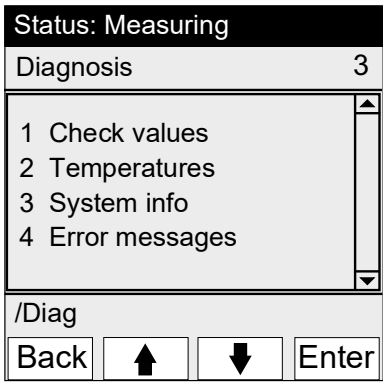
“Cyclic trigger” means: The respective program is started in a fixed cycle (hours, days or weeks).

- Cyclic trigger name
- Next start time (dd.mm.yy hh:mm:ss) or “-disabled-”.

- ▸ Disable the cyclic trigger
- ▸ Enable the cyclic trigger

8.5 Diagnosis

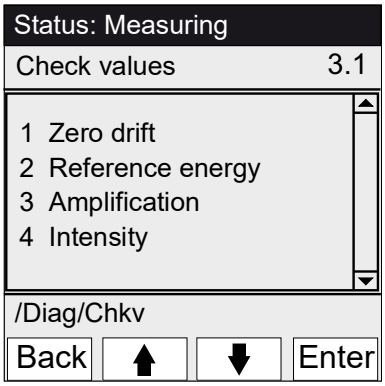
Menu 3: Diagnosis



see “Diagnosis/check values”, page 53
see “Diagnosis/temperatures”, page 54
see “Diagnosis/system info”, page 54
see “Diagnosis/error messages and Diag button”, page 54

8.5.1 Diagnosis/check values

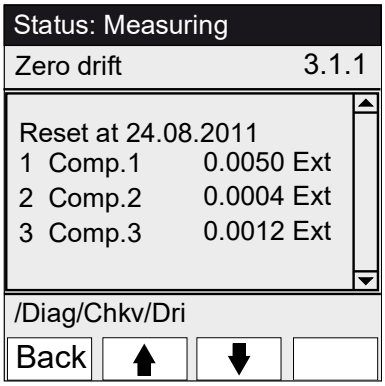
Menu 3.1: Diagnosis/Check values



see “Zero drift”, page 53
see “Reference energy”, page 53
see “Amplification”, page 53
see “Intensity”, page 54

8.5.1.1 *Zero drift*

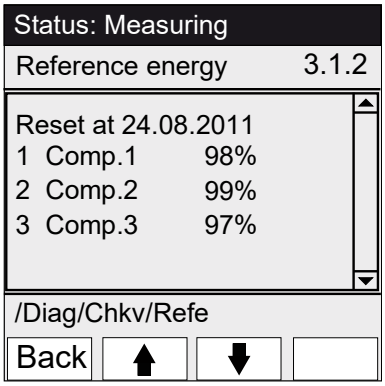
Menu 3.1.1: Diagnosis/Check values/ Zero drift



The zero drift since the last “Reset” of the zero drift (e.g., during maintenance, see “Parameter/reset”, page 56) is shown in this menu.
The zero drift is recalculated during each zero adjustment and displayed in extinction.
This value can be used for system diagnosis.
Typical cause: Decrease in lamp energy, contamination of cell windows.

8.5.1.2 *Reference energy*

Menu 3.1.2: Diagnosis/Check values/Reference energy



The actual reference energy (in percent) is shown in this menu.
This value is monitored automatically. If the value is below a limit value (default: 60%), the MCS300P Ex switches to classification “Maintenance request”. Typical cause: Contamination of cell windows or decrease in lamp energy.
A “Reset” (see “Parameter/reset”, page 56, e.g., during maintenance) sets the reference energy to 100%.

8.5.1.3 *Amplification*

Menu 3.1.3: Diagnosis/Check values/Amplification

The amplification levels of the measured components are shown in this menu.

The amplification levels serve as information for Endress+Hauser Customer Service.

8.5.1.4 *Intensity*

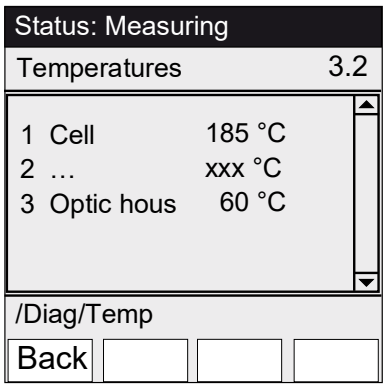
Menu 3.1.4: Diagnosis/Check values/Intensity

The intensities (energies) of the measured components are shown in this menu.

The amplification levels serve as information for Endress+Hauser Customer Service.

8.5.2 Diagnosis/temperatures

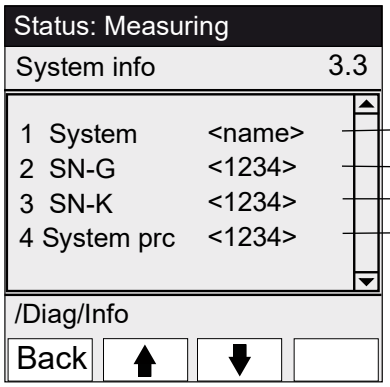
Menu 3.2: Diagnosis/Temperatures



The actual temperatures are shown in this menu.

8.5.3 Diagnosis/system info

Menu 3.3: Diagnosis/System info

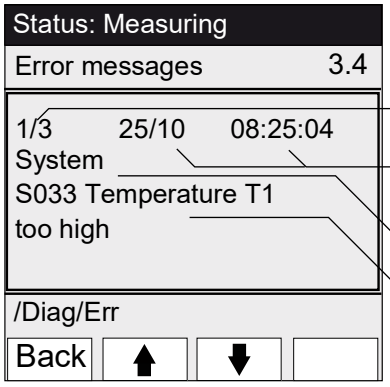


Device numbers and software versions are shown in this menu.

- Name of the system
- Serial number of device
- Serial number of cell
- System software version
- Etc.

8.5.4 Diagnosis/error messages and Diag button

Menu 3.4: Diagnosis/Error messages and <*Diag* button>

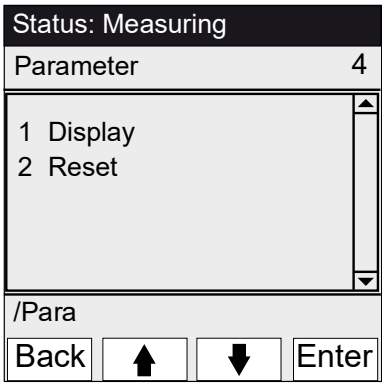


Existing messages are shown in this menu (Logbook → SOPAS ET).

- Message number / number of existing messages
- Date of occurrence (dd/mm)
  Time of occurrence (hh:mm:ss)
- Source (e.g., system, measured component, receiver, etc.)
- Error cause (error number and plain-text)
  (list of messages, see “Error messages and possible causes”, page 73)

8.6 Parameter

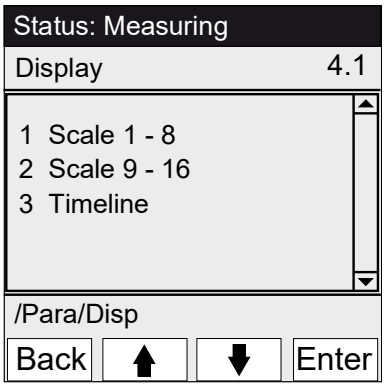
Menu 4: Parameter



see “Parameter settings/display”, page 55
see “Parameter/reset”, page 56

8.6.1 Parameter settings/display

Menu 4.1: Parameter/Display

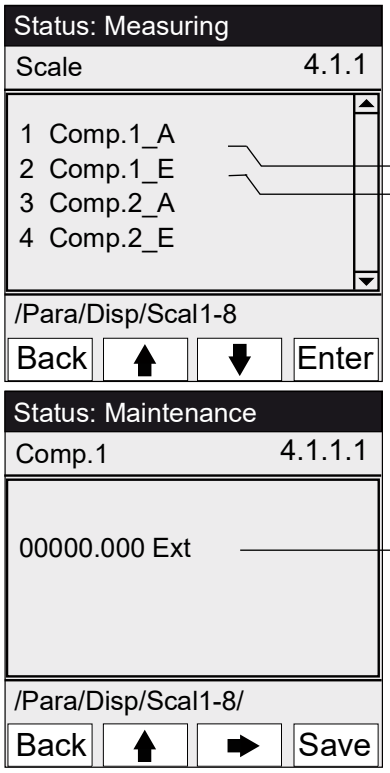


see “Scale”, page 56
see “Scale”, page 56
see “Timeline”, page 56

8.6.1.1 *Scale*

Menu 4.1.1: Parameter/Display/Scale 1 - 8

Menu 4.1.2: Parameter/Display/Scale 9 - 16



Bar graphs and line graphs are scaled in this menu. The scaling shown is valid for both types of graph.
Graph update interval: 1 second.

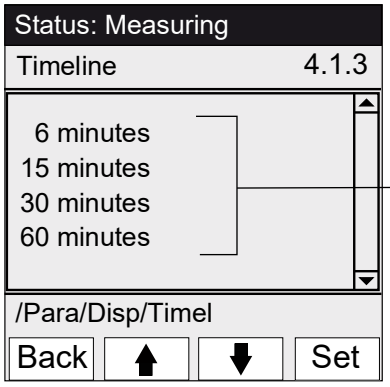
- _A: Scaling start value
- _E: Scaling end value

▸ Enter the numeric value.
For a minus sign: Press ⇧ 10 times before first digit.

Invalid entries (start value > end value) are not accepted.

8.6.1.2 *Timeline*

Menu 4.1.3: Parameter/Display/Timeline

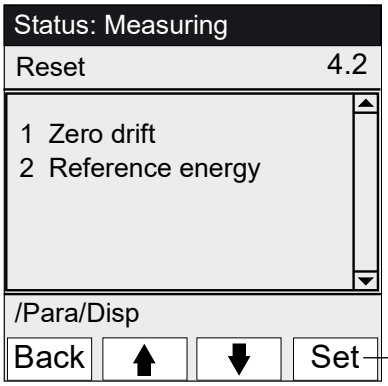


The parameters of the line graph timeline are set in this menu.
Graph update interval: Depending on scale (see ""Line graph" Measuring screen", page 43)

▸ Timeline end value (specified times)

8.6.2 Parameter/reset

Menu 4.2: Parameter/Reset



In this menu, the drifts/reference energies for all components are set to:

– "0" (for zero drift)
– "100%" (for reference energy)

The complete history is lost when the drifts/ reference energies are reset.

► Reset the drifts/reference energies only when you are sure that you want to reset the values.

9 Maintenance

9.1 Safety

Before working on the MCS300P Ex in potentially explosive atmospheres or when using combustible or occasionally explosive measured media, observe the general safety requirements, application conditions and personnel requirements, see “Operation in potentially explosive atmospheres”, page 13.

WARNING: Hazards through electric voltages

- ▶ Before opening the enclosure: Disconnect all MCS300P Ex poles from the power supply.

WARNING: Risk of toxic measured media in receiver unit

If the device is not operating correctly, it is possible that a filter filled with measured media is leaky and the measured medium is in the receiver unit.

- ▶ If it is necessary to open the receiver unit, do so in a well-ventilated room.

WARNING: Risk of explosion through residual voltages and hot surfaces

- ▶ Disconnect the MCS300P Ex from all external voltages (e.g., signal cables). Exception: Connections to intrinsically safe power circuits can remain connected.
- ▶ Do not open when an explosive atmosphere is present. (Enclosure contains batteries).

WARNING: Risk of suffocation when opening the enclosure

Protective gas escapes when the enclosure is opened.

Risk of suffocation when using inert protective gas.

- ▶ Do not inhale the escaping gas when opening the enclosure.

WARNING: Damage to eyes by radiation

Depending on the lamp type, eyes can be damaged by radiation.

- ▶ Before opening the cover of the sender unit: Switch all poles of the MCS300P Ex off at the external main power switch.

WARNING: Hot lamp

Components in the area of the lamp can be hot.

- ▶ Do not touch components in the area of the lamp; allow to cool down first.

9.2 Recommended spare parts

Spare part	Part No.
Desiccant cartridge (including assembly key)	2010549
Halogen lamp[1]	6023466
IR source insert[1]	2024574
IR chopper / source unit complete	2045537
UV chopper / source unit complete	2047806
24 V power supply unit	2152944
Cell-dependent spare parts → Cell Manual or System Documentation	

[1] Depending on device configuration

9.3 Maintenance plan

Interval[1]	Maintenance work	Reference
1W	Visual inspection	see “Visual inspection”, page 60
	Check the measured values for plausibility	
	Device with VIS source: Adjustment with zero gas[2] [3]	see “Adjustment”, page 48
1M	Device with IR source: Adjustment with zero gas[2] [3]	see “Adjustment”, page 48
	Adjustment with internal adjustment standard[4]	see “Adjustment/automatic”, page 49
6M	Check the desiccant cartridge and replace if necessary	see “Checking/replacing the desiccant cartridge”, page 61
	Adjustment of all measuring components with test medium	see “Adjustment”, page 48
6M	Function test of the pressurized enclosure system	see “Function test of the pressurized enclosure system”, page 60
1Y	Device with VIS source: Replace the source[2]	Replacement by trained skilled person or Endress+Hauser Service
	Recommendation: Maintenance work on the cell	see Operating Instructions of the cell
	Device with IR source: Check reference energy	see “Reference energy”, page 53
3Y[5]	Device with IR source: Replace the source[2]	Replacement by trained skilled person or Endress+Hauser Service

[1] 1W = weekly, 1M = monthly, 6M = half-yearly, 1Y = yearly
[2] Source type, see System Documentation
[3] Not required for devices with automatic zero point adjustment (see System Documentation)
[4] Option. See System Documentation
[5] Recommendation

9.3.1 Function test of the pressurized enclosure system

Procedure

1 Keep the MCS300P Ex in operation.
2 Interrupt protective gas feed to the MCS300P Ex.
The Ex control unit should signal an error state after a few minutes.
3 Start protective gas feed again.
The Ex control unit should now reset the error state and start the pre-purge phase.

9.3.2 Before commencing maintenance work

Before starting maintenance work, consider the following as applicable:

NOTICE: Risk of contamination when the device is switched off
When the device is switched off, there is a risk of contamination by measured medium remaining in the cell.
- Before switching the device off, purge the connected cell, pipes and possibly the liquid preheater for a sufficient period with inert gas.

▶ Set the maintenance signal (menu 1.1).
▶ Disable “Cyclic programs” (menu 2.3.3 or 2.3.4).

9.3.3 Visual inspection

MCS300P Ex

- Only the “*green*” LED on the operator panel lights and *no* measured value blinks. Otherwise: Press the <*Diag*> button to view the cause.
- Perform a visual inspection of the device enclosure
  - Dryness
  - Corrosion
  - Unusual smell
  - Unusual noises

Peripherals

- Sampling and discharging measured medium, pipes: Condition.
- Test medium supply: Condition, availability (use-by date), pressures.
- Protective gas: Condition, availability, pressures.

9.3.4 Zero and test medium supply

Feed a test medium with a defined test medium concentration (nominal value) and compare the displayed measured value with the nominal value.

▶ Feed the test medium at the cell inlet (For systems: See System Description delivered with the system).
▶ Test medium flow rate: See technical data of cell.

NOTICE:
The test medium must have approximately the same temperature as the cell (See System Description delivered with the system).
▶ E.g., provide heated lines or liquid preheater.

▶ Observe an adequate run-in time of the test medium until the measured value is stable.

In case of deviation:

- Check the flow rate of the medium.
- Check the medium path for leak tightness.
- Correct the measured value:
  - If programmed: In menu “Adjustment/automatic”, page 49 and see provided System Description
  - Or in menu “Adjustment/manual”, page 48 or in the respective menu in SOPAS ET

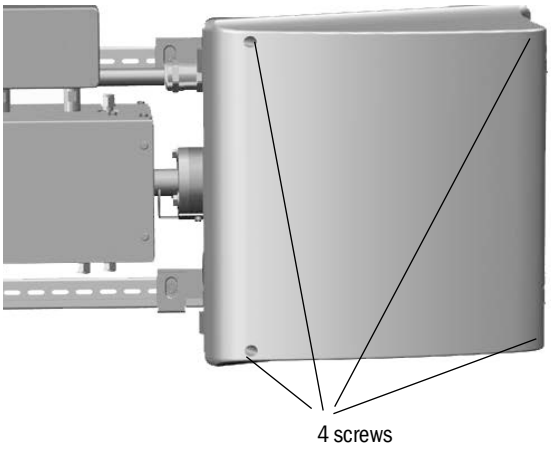
9.3.5 Checking/replacing the desiccant cartridge

Observe information on opening the enclosure (see “Safety”, page 58).

Spare parts	Part No.	Required for
Desiccant cartridge with key	2010549	----

Tool
5 mm Allen key

Fig. 19: Receiver unit screws

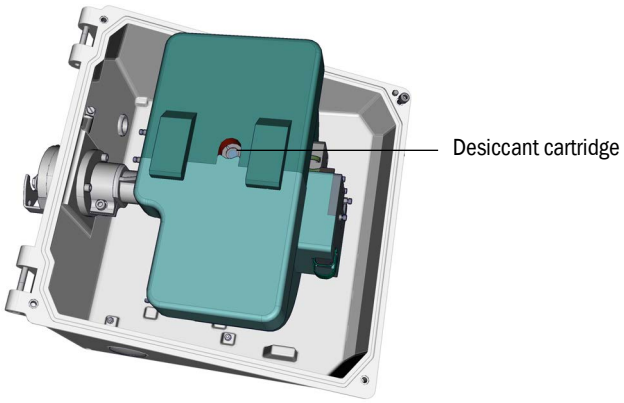


1 Disconnect the MCS300P Ex from the power supply using the external main power switch.

Do not open the device in an explosive atmosphere.

2 Unscrew the 4 screws (5 mm Allen key) of the receiver unit.
3 Open the cover.

Fig. 20: Desiccant cartridge



4 When the desiccant cartridge is *light blue*: Desiccant cartridge is dry and OK.
When the desiccant cartridge is *pink*: Desiccant cartridge is damp.
▶ Replace the desiccant cartridge.
5 Replace the desiccant cartridge:
a) Unscrew the desiccant cartridge with the key.
b) Screw in the new desiccant cartridge.
6 Close the receiver unit again.
Make sure sealing surfaces are clean and seals are properly seated.
7 Start the MCS300P Ex again (see “Measuring screens”, page 42).

9.3.6 Removing/fitting the cell


CAUTION: Acid, risk of chemical burns
The cell and connected lines could contain caustic or corrosive media (noxious or irritating substances).
Risk of splashing when lines are removed or cut off.
▶ Take suitable protective measures when working on parts exposed to the measured medium (e.g., wear protective goggles or a safety mask, protective gloves and acid-proof protective clothes).

WARNING: Hot surfaces
▶ Before touching heated assemblies, allow to cool down first.

NOTICE: Risk of contamination when the device is switched off
When the device is switched off, there is a risk of contamination by measured medium remaining in the cell.
- Before switching the device off, purge the connected cell, pipes and possibly the liquid preheater for a sufficient period with inert gas.

Observe information on opening the enclosure (see “Safety”, page 58).

Spare parts	Quantity	Part No.
O-ring (cell flange)	2	5310003 (1 pc)
Cell-dependent spare parts → Cell Manual or System Documentation		

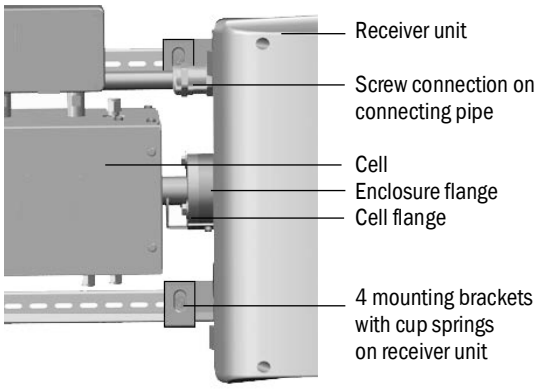
Tool
4 mm Allen key
10 mm open-end wrench
30 mm open-end wrench

Preparation work

1 Note reference energy *and* intensities (see menu: *Diagnosis/Check values*) (to compare the energy after mounting).
2 Put the MCS300P Ex out of operation and disconnect all poles from the power supply with the external main power switch.

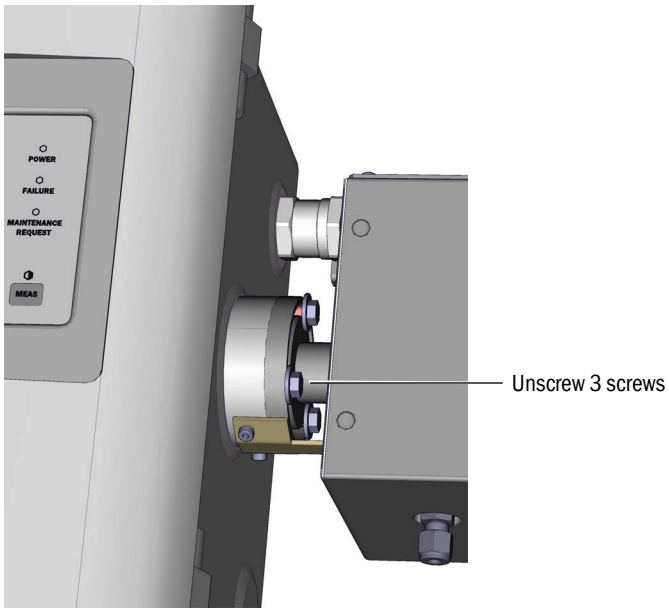
Removing the cell

Fig. 21: Screw connections on receiver side



1 Remove all pipes from the cell.
2 If necessary, disconnect the cell electric cables on the cell (→ Cell Operating Instructions).
3 Loosen the 4 mounting brackets on the receiver unit (do not remove).
4 Unscrew the screw connection of the connecting pipe on the receiver unit side (see Fig. 24, page 66).
5 Unscrew the 3 screws of the vario flange (on sender and receiver unit).

Fig. 22: Vario flange (shown on the sender unit)



6 Push the receiver unit approx. 5 mm to the right or down.

NOTICE:
Vertical mounting: Make sure that the receiver unit does not slide down out of the G-type rails and drop down.

7 Remove the cell.
Vertical mounting: Immediately tighten the mounting brackets of the receiver unit.

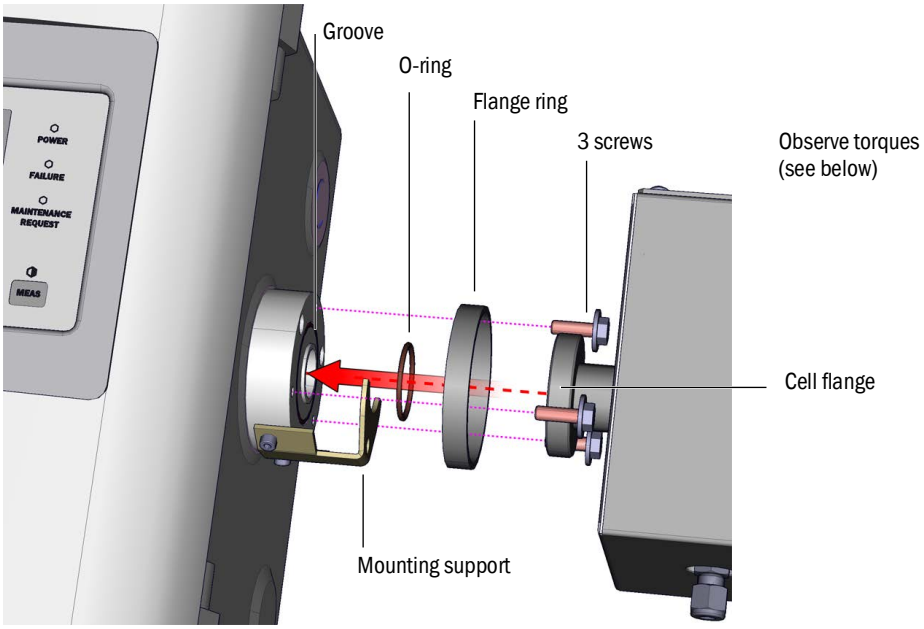
NOTE:
Information on work on the cell or cell heater:
→ Cell Operating Instructions and System Documentation.

Installing the cell

- Preferred cell position:
  - Gas cell: Gas feed and discharge lines from below, heating connection up.
  - Liquid cell: Liquid inlet from below, liquid outlet up.

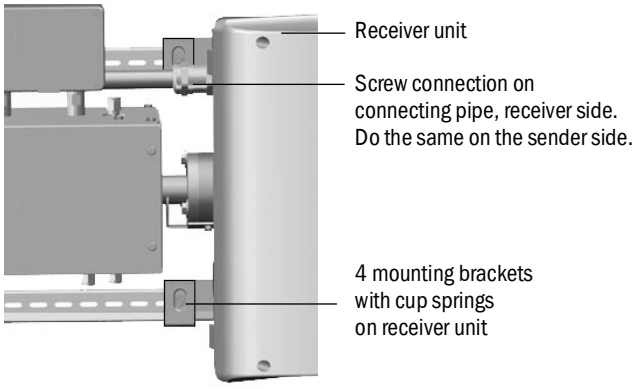
1 Place 1 O-ring each into the groove on the sender or receiver unit (the outer groove remains empty).

Fig. 23: Cell installation (shown on the sender unit)



2 Insert the cell: Place the flange ring and cell flange on the flange of the sender or receiver unit (see Fig. 23, page 66).
3 Turn the cell into the correct position and push the receiver unit to the left or upwards until the cell is clamped.
4 Screw on the cell on the receiver and sender side with 3 screws each (M6x20, DIN 933) and 2 washers each (DIN 137 and DIN 9021).

Fig. 24: Connecting pipe, receiver side



5 Tighten the screw connection of the connecting pipe again.
Torques:
  - Receiver side: 1 Nm (see “Connecting pipe, receiver side”, page 66)
  - Sender side: 2 Nm

6 Screw the 4 mounting brackets and cup springs loosely on the receiver unit so that enough clearance remains for temperature equalization.

Final steps

1 Screw the tubes for the measured medium back onto the cell or possibly the liquid preheater.
2 If necessary, connect the electric cables to the cell heating.
3 Perform a leak test (depending on the cell or possibly the liquid preheater used and the measured medium used).
4 Put the MCS300P Ex back into operation.
5 Compare the intensity (Menu: *Diagnosis/Check values/Intensity*) with the notes made: The intensity must not have deteriorated significantly.
If this is the case: Please contact Endress+Hauser Service.
6 Compare the reference energy (Menu *Diagnosis/Check values/Reference energy*) with the notes made: The reference energy must not have deteriorated significantly.
If this is the case: Reset the reference energy (see Menu: *Reset/Reference energy*).
7 Perform the adjustment of zero point and span point (see Menu *Adjustment*).

10 Troubleshooting

10.1 Safety

Before working on the MCS300P Ex in potentially explosive atmospheres or when using combustible or occasionally explosive measured media, observe the general safety requirements, application conditions and personnel requirements, see “Operation in potentially explosive atmospheres”, page 13.

WARNING: Hazards through electric voltages

- ▶ Before opening the enclosure: Disconnect all MCS300P Ex poles from the power supply.

WARNING: Risk of toxic measured media in receiver unit

If the device is not operating correctly, it is possible that the filter filled with measured media is leaky and the measured medium is in the receiver unit.

- ▶ If it is necessary to open the receiver unit, do so in a well-ventilated room.

WARNING: Risk of explosion through residual voltages and hot surfaces

- ▶ Disconnect the MCS300P Ex from all external voltages (e.g., signal cables). Exception: Connections to intrinsically safe power circuits can remain connected.
- ▶ Do not open when an explosive atmosphere is present. (Enclosure contains batteries).

WARNING: Risk of suffocation when opening the enclosure

Protective gas escapes when the enclosure is opened.

Risk of suffocation when using inert protective gas.

- ▶ Do not inhale the escaping gas when opening the enclosure.

WARNING: Damage to eyes by radiation

Depending on the lamp type, eyes can be damaged by radiation.

- ▶ Before opening the cover of the sender unit: Switch all poles of the MCS300P Ex off at the external main power switch.

WARNING: Hot lamp

Components in the area of the lamp can be hot.

- ▶ Do not touch components in the area of the lamp; allow to cool down first.

10.2 When the MCS300P Ex fails

Possible cause	Notes
Power supply has failed.	Check power supply (e.g., external switch, external fuses).
Defective internal fuse.	Check fuses (see “Fuses”, page 71).
Software not working correctly.	Switch the MCS300P Ex off at the external main power switch and switch it on again after a few seconds.
Ex control unit does not switch on.	Protective gas feed interrupted or too low.
	Ex control unit indicates an error (see Pressurized Enclosure System Manual).
	Enclosure parts are not closed properly (→ check screw fittings).

10.3 When measured values are incorrect

Possible cause	Notes
The MCS300P Ex is not measuring the measured medium.	Check measured medium path and all valves (e.g., switching from test medium to measured medium).
Measured medium path leaks.	Check installations.
The MCS300P Ex is not correctly adjusted.	Perform an adjustment (see “Adjustment”, page 48); check the test media first (nominal value, service life, throughflow and the concentrations in Menu 2.3.1).

10.4 Malfunction messages

A malfunction has occurred when:

- The measured values blink.
- The “*yellow*” LED lights.
- The “*red*” LED lights.

▶ Press the <*Diag*> button for more information (list with error messages and possible causes, see “Error messages and possible causes”, page 73).

NOTE:
For more information concerning operating and display elements, see “Operating and display elements”, page 39

10.5 Heater failure

The MCS300P Ex has two heater controllers with temperature monitors to heat external assemblies (e.g., cell, heated measured medium line and possibly liquid preheater).

- Both heaters are switched off when one temperature exceeds the allowable limit value (depending on the temperature class).
- After 15 minutes, the MCS300P Ex switches to error state “Failure” (see “Classification, LEDs”, page 41) because both heated assemblies cool down.

▶ Switch the MCS300P Ex off and on again to switch the heaters back on.

10.6 Overpressure monitoring failure

- MCS300P Ex category 2G: A control unit failure triggers an automatic switch-off of the MCS300P Ex.
- MCS300P Ex category 3G: A control unit malfunction is only indicated with an alarm signal on the Ex control unit with no automatic switch-off of the MCS300P Ex.

NOTE:
Further information → Pressurized Enclosure Manual (see “Further information”, page 8)

10.6.1 Possible causes

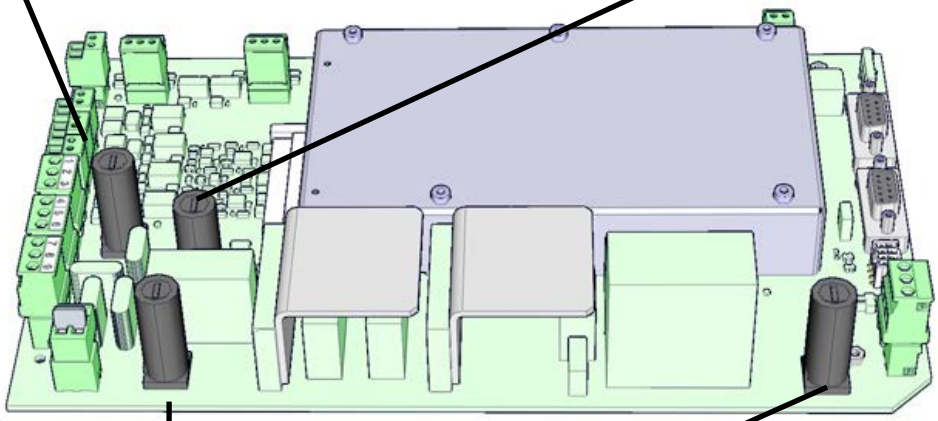
Possible cause	Possible clearance
Protective gas feed interrupted	Check protective gas feed
Screw fittings on connecting pipe leaky	Tighten screw fittings Torques: Receiver side: 1 Nm (see “Connecting pipe, receiver side”, page 66) Sender side: 2 Nm
Enclosure of sender or receiver unit leaky	Check screw fittings and seals (as shown in see “Receiver unit screws”, page 61).

10.7 Fuses

Fig. 25: Fuses

Controller 1 fuse (cell)		
Input voltage	Fuse rating	Part No.
240 V	2.5 A	6004305
120 V	5 A	6023695

Main fuse		
Input voltage	Fuse rating	Part No.
240 V	6.3 A	6006661
120 V	10 A	6000297



Power supply unit fuse		
Input voltage	Fuse rating	Part No.
240 V	1 A	6004298
120 V	2 A	6004303

Controller 2 fuse		
Input voltage	Fuse rating	Part No.
240 V	2.5 A	6004305
120 V	5 A	6023695

1 Put the MCS300P Ex out of operation (see “Safety”, page 77) and disconnect all poles.
2 Loosen the 4 screws of the sender unit (5 mm Allen key).

WARNING: Risk when opening the sender unit
▶ Observe warning information, see “Opening the sender unit”, page 30 and see “Safety”, page 68

3 Open the cover.
4 Check and, If necessary, replace the fuses.

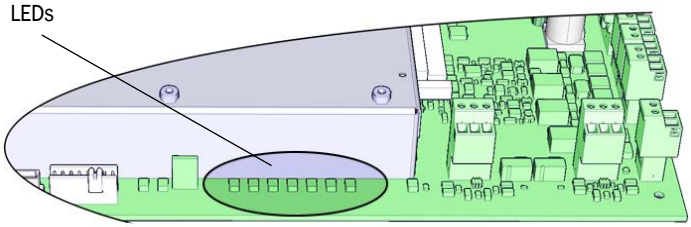
NOTE:
Fuse ratings depend on the input voltage.
▶ Only use fuses with the correct fuse rating.

5 Close the sender unit. Check for leaks.

10.7.1 LEDs on circuit board

If no LED is on: Check “Power supply unit” fuse (see “Fuses”, page 71).

Fig. 26: Position of the LEDs



10.8 Error messages and possible causes

Source	Code	Error text	Classifi-cation	Description	Possible clearance[1]
System	S001	Temperature T1 too high	Failure	If T1 > (nom.temp + param.limit)	Check the heater
	S002	Temperature T2 too high		If T2 > (nom.temp + param.limit)	
	S003	Temp. 1 not reached		After 60 min. in current operation: 15 min (see “Heater failure”, page 70)	
	S004	Temp. 2 not reached			
	S005	Temperature sensor 1		OVO (HC3X) signals that the input range of an analog input (temperature sensor) was exceeded	
	S006	Voltage range		OVO (HC3X) signals that the input range of an analog input (temperature sensor) was exceeded	Please contact Endress+Hauser Customer Service.
	S007	Check sum error		OVO (HC3X) signals that the input range of an analog input (temperature sensor) was exceeded	
	S008	Chopper signal missing		This message is first displayed when the receiver has set the corresponding bit 5 times (seconds) in succession	
	S009 S010 S011	Motor x: Ref.pos.incorrect		Filter wheel motor x does not detect the reference position	
	S012	No emitter detected		No emitter detected	Check the power supply of the emitter and replace If necessary
	S013	Communication error		During important routines or when S062 occurred 30 times	Please contact Endress+Hauser Customer Service.
	S014	No result		No measval or ecorr file	
	S015 S016 S017	Motor x: defect		If, from system start, 30 step losses or 30 watchdog actions	
	S018	Source failure		Detection I < 0.1 A	Check the emitter and replace If necessary
	S019	Chopper error		Detection: f_Motor < 50 Hz or sender SW signals chopper error	Please contact Endress+Hauser Customer Service.
	S020	Configuration error		CONF (HC3X)	
	S021	Communication error		COM (HC3X)	
	S022	Controller not found		EXIST (HC3X)	
	S023	Frequent reset		Receiver, sender. If error occurred 30 times as from system start	
	S024	No active component		If “Active” checkmarks of all components disabled	Check in SOPAS ET

[1] This Table also contains recommended solutions that should only be performed by specially trained personnel.

Source	Code	Error text	Classification	Description	Possible clearance[1]
System	S025	Evaluation module failure	Failure	Evaluation module could not be started	Please contact Endress+Hauser Customer Service.
	S026	Evaluation module: File error		Files for evaluation module were not set up (espec, config, condition, measval)	
	S027	Updating low		TOO (HC3X)	
	S028 S029 S030	Motor x: communication		No communication with motor x	
	S031	Optics temp. too high		If optics temp. > 1.05 * 60 °C = 63 °C	
	S032	Temperature sensor 1		OVO (HC3X) signals that the input range of an analog input (temperature sensor) was exceeded	Check the heater
	S113	Check sum error		BCK (I/O) indicates that the transmission process performed beforehand from the master to the slave (controller) had an incorrect check sum and the slave has not accepted the data.	Check the I/O modules, cable damage
	S114	Communication error		COM (I/O) communication error with an I/O module	
	S115	High/low voltage		PFO (I/O) signals that the internal power supply of the 5 V and 24 V input voltages has determined a range overflow or underflow	Please contact Endress+Hauser Customer Service.
	S116	Output without current		TOO (I/O) signals that the output was switched free from current because of the time-out.	Check the I/O modules, cable damage

[1] This Table also contains recommended solutions that should only be performed by specially trained personnel.

Source	Code	Error text	Classification	Description	Possible clearance[1]
System	S033	Dev. zero point too high	Maintenance request	Parameters set for measured component	Check the zero gas, contamination
	S034	Configuration I/O module		CONF (I/O) configuration error, module found does not correspond to nominal configuration	Check the IO modules, check the parameters: IO hardware plan
	S035	Ref.energy too low		Parameters set for measured component	Check the emitter current, contamination: clean/replace cell window
	S036	Optics temp. not reached		Delay time: 1800 s = 30 min	Please contact Endress+Hauser Customer Service.
	S037	VIS: source current low		Only UV: current: 50% (I_max = 2.8 A) --> message If I < 1.4 A	Check the emitter and replace If necessary
	S038 S039	Channel x error		OV0 (I/O) signals that the current required on the analog module connection (node y, module z) is not reached.	Check the I/O modules, cable damage
	S042	Busy		BSY (I/O and HC3X) signals that the microcontroller of the module is still busy executing the last command	Please contact Endress+Hauser Customer Service.
	S043	IR: Emitter voltage high		Only IR: Voltage: 150% of V_max (V_max = 3.5 V) → message if U > 5.3 V	Check the emitter and replace If necessary
	S044	Chopper tight		Detection: If setting variable > 1000	Please contact Endress+Hauser Customer Service.
	S045	Factor invalid: medium		If the F_Medium calculation is refused because it is outside the tolerable range; parameters set with measured component	Check the test medium, check the input of the test medium concentration, contamination
	S046	Factor invalid: filter		If the F_Filter calculation is refused because it is outside the tolerable range; parameters set with measured component	Check the zero gas, contamination
	S049	FlashCard not detected		FlashCard not detected	Please contact Endress+Hauser Customer Service.
	S050	Factor=zero medium/ filter		If one of the factors F_Medium or F_Filter is in the range -0.000001 < x < 0.000001	Check the test medium, check the input of the test medium concentration, contamination

[1] This Table also contains recommended solutions that should only be performed by specially trained personnel.

Source	Code	Error text	Classification	Description	Possible clearance[1]
System	S057	sin/cos-overflow	Uncertain	If at least one value of 100 averaged less than -2^{15} or greater than $+2^{15}$	Please contact Endress+Hauser Customer Service.
	S058	Temperature 1 too low		If T1 < nom.temp. - param.limit	Wait. After a restart, max. 60 min., during operation: 15 min
	S059	Temperature 2 too low		If T2 < nom.temp. - param.limit	
	S060	Temp. optics too low		If optics temp. < 60 °C * 95% = 57 °C	Wait for max. 30 min.
	S061	Chopper frequency range		If chopper frequency: 125< x < 131	Please contact Endress+Hauser Customer Service.
	S062	Communication problem		Sender and receiver for cyclic routines (reading out of measurement signals, diagnosis values)	
	S063	Wrong no. of filter wheels		According to the SOPAS ET parameters, fewer filter wheels defined than actually present in the device	Check the SOPAS ET parameters

[1] This Table also contains recommended solutions that should only be performed by specially trained personnel.

Source	Code	Error text	Classification	Possible clearance
Evaluation process	E001	Unknown command	Failure	Please contact Endress+Hauser Customer Service.
	E002	OS error		
	E003	Incorrect configuration		
	E004	Incorrect configuration		
	E005	Internal file error		
	E006	Incorrect configuration		
	E007	Internal file error		
	E008	Internal file error		
	E009	Internal file error		
	E010	Incorrect configuration		
	E011	Incorrect configuration		
	E012	Incorrect configuration		
	E013 ... E021	Internal file error		
	E022	Resolution out of range		
	E023	Numerical error		
	E024	Incorrect configuration		
	E025	Internal file error		
	E026	Numerical error		
	E027	Incorrect configuration		
	E028	Incorrect configuration		
	E029	Unknown failure		
	E030	OS error		
	E031	OS error		
	E032	Internal file error		
	E033	Internal file error		
	E034	Internal file error		
	E035	Numerical error		
	E036	Syntax error		
	E037	Processing error		
	E038	Absorption too high		
	E039	Internal file error		
	E040	Internal file error		

Source	Code	Error text	Classification	Possible clearance
Evaluation process	E097	Evaluation uncertain	Uncertain	Please contact Endress+Hauser Customer Service.
	E098	Medium temp. too high/low		
	E099	Medium pressure too high/low		
	E100	Medium flow too high/low		
	E101	Measured value too high/low		
	E102	Evaluation uncertain		
	E103	Evaluation uncertain		

11 Decommissioning

11.1 Safety

Before working on the MCS300P Ex in potentially explosive atmospheres or when using combustible or occasionally explosive measured media, observe the general safety requirements, application conditions and personnel requirements, see “Operation in potentially explosive atmospheres”, page 13.

WARNING: Hazards through electric voltages

- ▶ Only let the work described in the following be carried out by skilled electricians who can recognize potential risks.
- ▶ Before opening the enclosure: Disconnect all MCS300P Ex poles from the power supply.

WARNING: Acid, risk of chemical burns

The cell and connected lines could contain caustic or corrosive media (noxious or irritating substances).

Risk of splashing when lines are removed or cut off.

- ▶ Take suitable protective measures when working on parts exposed to the measured medium (e.g., wear protective goggles or a safety mask, protective gloves and acid-proof protective clothes).

NOTICE: Risk of contamination when the device is switched off

When the device is switched off, there is a risk of contamination by medium remaining in the cell.

- ▶ Before switching the device off, purge the connected cell and pipes for a sufficient period with inert gas.

WARNING: Risk of explosion through residual voltages and hot surfaces

- ▶ Do not open when an explosive atmosphere is present. (Enclosure contains batteries).

WARNING: Risk of explosion caused by measured media residues

When using combustible and explosive measured media:

- ▶ Before switching the device off, purge the connected cell, pipes and possibly the liquid preheater for a sufficient period with inert gas.

11.2 Decommissioning the MCS300P Ex

NOTE:

To switch the device off for a short time, use the “*System stop*” function (see “System stop”, page 46).

1 Set the maintenance signal (see “Maintenance/maintenance signal”, page 45).
2 Feed inert gas into the cell:
  – manually or
  – with the program (if parameters were set).
3 Allow the MCS300P Ex to run in this state long enough so that the cell, the liquid preheater (optional) and the connected lines are purged of the measured medium (duration depends on the measured medium).
4 Disconnect the MCS300P Ex from the power supply.
5 Disconnect the Ex control unit from the power supply.
6 If heated assemblies are connected: Disconnect these assemblies from the power supply.
7 If necessary, remove liquid from the cell and the liquid preheater (optional) and allow the cell to dry.

11.3 Disposal

▶ The MCS300P Ex can easily be disassembled into its components which can then be sent to the respective raw material recycling facilities.

WARNING: Gases in gas filters
Depending on the application, MCS300P Ex gas filters (option) contain minor gas volumes which represent a hazard only under particularly unfavorable circumstances.
- ▶ Do not destroy gas filters directly in front of your face and do not directly inhale emerging gases.
- ▶ Do not destroy gas filters in small, closed rooms, especially when large quantities must be destroyed.

The gas filters are located on the filter wheel in the receiver unit.

The following assemblies contain substances that may have to be disposed of separately:
- *Electronics*: Condensers, batteries.
- *Display*: Liquid of LC display.
- *Measured medium paths*: Toxic substances of the measured medium can adhere to, or possibly penetrate, soft materials of the measured medium path (e.g., hoses, O-rings).

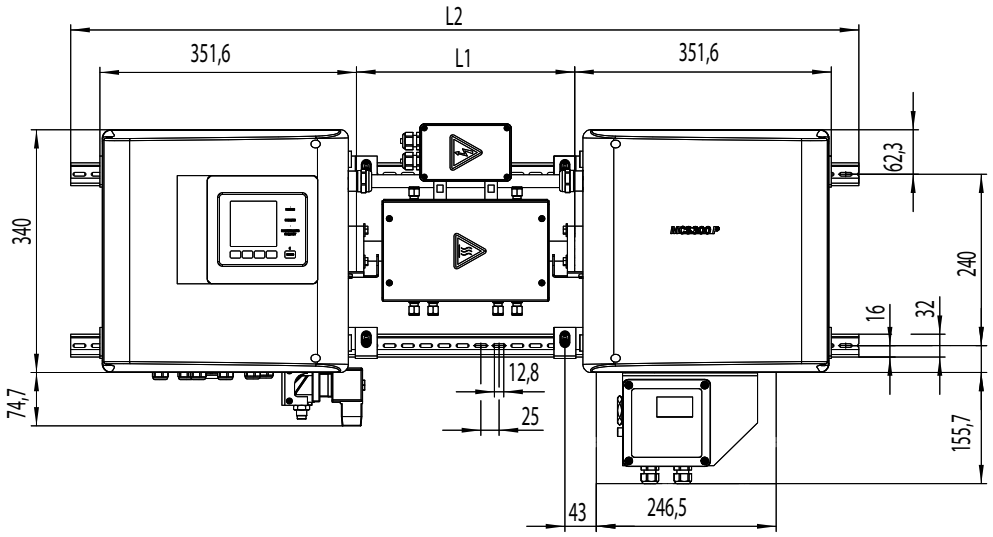
12 Technical data

NOTE:
The MCS300P Ex equipment depends on the application.
Refer to the System Documentation delivered with the MCS300P Ex for the fitted equipment.

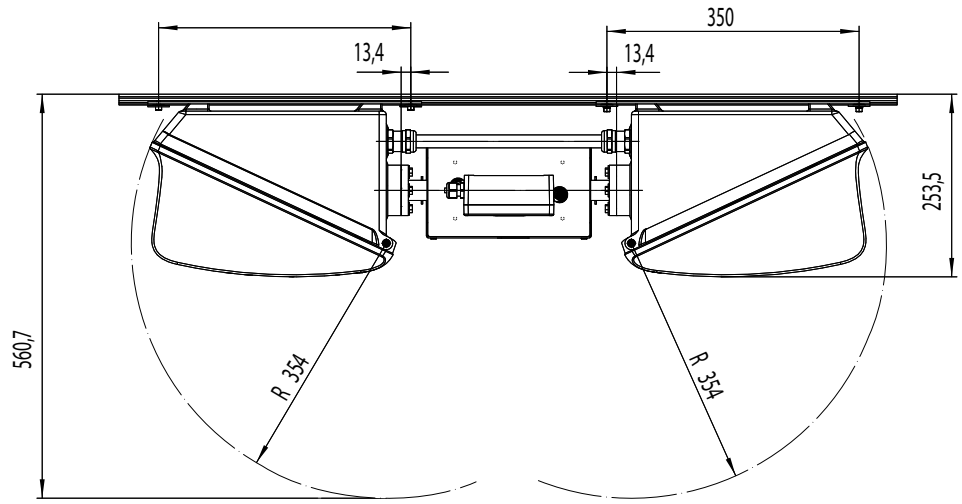
12.0.1 Dimensions and drilling diagram

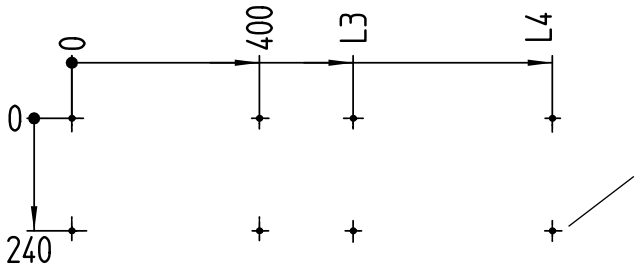
NOTE:
▶ The measuring device must be installed with a clearance of at least 20 cm on all sides.

Fig. 27: Horizontal mounting shownt



Ex control unit dimensions 246.5 and 155.7 are applicable for FS840 and FS850S (maximum dimension)





Drilling diagram

Threaded hole M5 or dowel hole for M5

Dimensions in mm (in) and weights in kg (lb) with typical Endress+Hauser Ex cells:

Cell	L1	L2	L3	L4
FGK Ex	259 (10.2)	1080 (42.5)	575 (22.6)	1000 (39.4)
PGK10 Ex	299 (11.8)	1080 (42.5)	600 (23.6)	1025 (40.4)
PGK20 Ex	399 (15.7)	1180 (46.5)	700 (27.6)	1125 (44.3)
PGK50 Ex	699 (27.5)	1480 (58.3)	1000 (39.4)	1425 (56.1)
PGK75 Ex	949 (37.4)	1730 (68.1)	1250 (49.2)	1675 (65.9)

12.0.2 Measured value recording

Measuring principle	Photometer, interference and gas filter correlation method
Spectral range	VIS version: 300 ... 1200 nm IR version: 1200 ... 11000 nm
Measured components	All IR-/NIR-/VIS-active gases and liquids. Simultaneously up to 6 components, e.g., CO, CO_2, NO, NO_2, N_2O, HCl, NH_3, H_2O, hydrocarbons, Cl_2.
External sensors	Read-in and processing of up to 4 external sensors.
Number of measuring ranges	2, automatic measuring range switch-over (adjustable)
Cross-sensitivity compensation	Max. 6 disturbance variables (also external disturbance variables)
Detection limit	< 2% of respective measuring range
Zero drift	VIS: < 1% of full scale / day IR: < 2% of full scale / week
Temperature effect	< 2% of respective measuring range / 10 K
Setting time t_{90}	Approx. 30 ... 120 s, adjustable specific for system and component
Limit values	2 limit values per measured component
Measuring point switching	Max. 8 measuring points

12.0.3 Enclosure specification

Enclosure material	Aluminum, coated
Weight	Approx. 30 kg (66 lb) (without cell and liquid preheater)
Highest surface temperature	+47 °C (+117 °F)
Degree of protection	IP65 (cell and liquid preheater separate)
Impact resistance	IK08
Heating temperature Max. surface temperature	T3: 150 °C (302 °F) T4: 130 °C (266 °F)

12.0.4 Ambient conditions

Ambient temperature	+5 ... +40 °C (+40 ... +105 °F)
Storage temperature	–20 ... +60 °C (-5 ... +140 °F)
Relative humidity	Max. 80% (non-condensing)
Installation location	Indoor installation
Installation height	Up to 2000 m above sea level
Air pressure	850-1100 hPa
Contamination level	4

12.0.5 Interfaces and protocols

Analog outputs[1]	0/4 ... 22 mA, electrically isolated; max. load resistance 500 Ohm
Analog inputs[1]	0/4 ... 22 mA, electrically isolated; input resistance: 100 Ohm
Digital inputs[1]	Open contact; potential-free
Digital outputs[1]	Power relay, electrically isolated outputs and potential-free outputs
Interface	Ethernet (depending on individual version)
PC operation	SOPAS ET via Ethernet

[1] Number dependent on device configuration: → System Documentation

12.0.6 Cable glands

Connection	Type	Size	Clamping range mm	Tightening torque Nm
Power supply	EMV Ex	M16	5 ... 10	5
Heater				
PT100				
Signal I/O		M20	10...14	10
CAN interface				
ETH interface	EMV-D Ex	M16	5 ... 10	11

12.0.7 Electrical connection

Input voltage	1~230 V ± 10%; 50 ... 60 Hz or 1~115 V ± 10%; 50 ... 60 Hz
	Ex control unit: See Operating Instructions of installed control unit
Power input	Analyzer: Max. 230 VA – with cell heater: Max. 805 VA – with second heater: Max. 1450 VA
Power supply cable cross-section	3 x 1.5 mm^2 (AWG16)
Protection class:	I
Overvoltage category	2
Power system	TN-S

12.0.8 Heater outputs

Heater outputs	2 outputs, each max. 550 VA

12.0.9 Connection terminals

Table 2: Protective conductor

Conductor	Cross-section in mm²	Cross-section in AWG	Tightening torque Nm
Rigid	2.5	14	1.2
Flexible with ferrules	1.5	16	
Flexible with ferrules with insulating collar	1.5	16	

Table 3: Input voltage, heating

Conductor	Cross-section in mm²	Cross-section in AWG	Tightening torque Nm
Rigid	0.2…2.5	24…12	0.5…0.6
Flexible with ferrules	0.25…2.5	26…12	
Flexible with ferrules with insulating collar	0.25…1.5	26…12	

Table 4: Potential equalization

Conductor	Cross-section in mm²	Cross-section in AWG	Tightening torque Nm
Rigid	6.0	10	2.0
Flexible with ferrules	4.0	11	
Flexible with ferrules with insulating collar	4.0	11	

Table 5: CAN interfaces, PT100

Conductor	Cross-section in mm²	Cross-section in AWG	Tightening torque Nm
Rigid	0.14…1.5	28…16	0.22…0.25
Flexible with ferrules	0.25…1.5	26…16	
Flexible with ferrules with insulating collar	0.25…0.5	26…20	

12.0.10 Torques

Tighten all screw connections, for which no tightening torque or no pretension force is specified in drawings or Mounting Instructions, according to VDI 2230.

All connections with screws which are not classic screw connections are excluded from this rule. This means strap retainers, cable glands, screw fittings, measured medium connections, screws for circuit boards etc. Here, the screw fittings have to be tightened as evenly as possible with a significantly lower tightening torque (strap retainers 1 Nm, other screw fittings according to manufacturer specification).

Select the next lowest torque valid for the screw for mixed materials and special screws such as relieved screws.

The basic friction coefficient is (screw fittings without lubrication) μk=μG=0.14. The calculated values are valid for room temperature (T=20 °C).

Table 6: Torques

Dimension M	**Pitch P**	**Tightening torque Ma (Nm)**					
		3.6	**4.6**	**5.6**	**8.8, A2 and A4-80**	**10.9**	**12.9**
1.6	0.4	0.05		0.05	0.17		0.28
2	0.45	0.1		0.11	0.35		0.6
2.5	0.45	0.21		0.23	0.73		1.23
3	0.5		0.54	1	1.3	1.7	2
3.5	0.6		0.85	1.3	1.9	2.6	3.2
4	0.7		1.02	2	2.5	4.4	5.1
5	0.8		2	2.7	5	8.7	10
6	1		3.5	4.6	10	15	18
8	1.25		8.4	11	25	36	43
10	1.5		17	22	49	72	84
12	1.75		29	39	85	125	145
14	2		46	62	135	200	235
16	2		71	95	210	310	365
18	2.5		97	130	300	430	500
20	2.5		138	184	425	610	710
22	2.5		186	250	580	830	970
24	3		235	315	730	1050	1220
27	3		350	470	1100	1550	1800
30	3.5		475	635	1450	2100	2450
33	3.5		645	865	2000	2800	3400
36	4		1080	1440	2600	3700	4300
39	4		1330	1780	3400	4800	5600

12.1 Parameters for pressurized enclosure system

12.1.1 Protective gas

Protective gas	Instrument air or inert gas – Particle size max. 1 µm – Oil content max. 0.1 ppm – Dew point –30 °C (–22 °F)
Connections – Inlet: – Outlet:	 – G ⅜" thread *or* – hose connection for 8 mm diameter – *For version ATEX-2G:* G 1" thread – *For version ATEX-3G:* G ¾" thread
Inlet temperature:	+5 … +40 °C (+40 … +105 °F)
Primary pressure: – Max.: – Min.:	 2500 hPa (2.5 bar) (36 psi) (relative) 2000 hPa (2 bar) (30 psi) (relative)

12.1.2 Enclosure data

Enclosure data	
Free volume:	40 l (2440 in^3)
Minimum overpressure:	80 Pa (0.8 mbar) (0.012 psi) (relative)
Maximum overpressure:	1800 Pa (18 mbar) (0.26 psi) (relative)

Pre-purging during commissioning	
Typical pre-purge time:	Approx. 6 minutes

12.1.3 Pressurized enclosure system settings for ATEX-2G

Pressurized enclosure system used: Gönnheimer FS850S

WARNING: Risk of explosion with incorrect parameters

▶ Do not change parameters.
(The parameter password is specific for Endress+Hauser and only available for -Endress+Hauser Customer Service)

FS850S parameters	Setting
Valve control:	Proportional valve (P-valve)
Operating mode:	Leakage compensation (purging not continuous)
Purge amount:	500 l (30000 in^3))
Nominal purge pressure:	10 mbar (0.145 psi) (relative)
Minimum pressure in enclosure:	0.8 mbar (0.012 psi) (relative)
Maximum pressure in enclosure:	18 mbar (0.26 psi) (relative)
Nominal pressure in enclosure:	2 mbar (0.03 psi) (relative)
Signal pressure:	1.5 mbar (0.022 psi) (relative)

12.1.4 Pressurized enclosure system settings for ATEX-3G

Pressurized enclosure system: Gönnheimer FS840

WARNING: Risk of explosion with incorrect parameters

▶ Do not change the parameters of FS840 and the purge valve setting.
(The parameter password is specific for Endress+Hauser and only available for -Endress+Hauser Customer Service)

FS840 parameters	Setting
Pre-purging:	Yes
Purging method Auto:	Yes
Input function:	None
Output function A1 (signal contact 1):	Ex OK
Control direction A1 (signal contact 1):	Normally open (N/O)
Output function A2 (signal contact 2):	p<p alarm
Control direction A2 (signal contact 2):	Normally open (N/O)
Volume[1]:	50 l (3000 in^3)
Primary pressure[2]:	2.0 mbar (29 psi) (relative)
Nozzle:	2.0 mm (0.079 m)
Minimum pre-purging pressure:	7.0 mbar (0.1 psi) (relative)
Minimum pressure in operation:	0.8 mbar (0.012 psi) (relative)
Signal pressure	1.5 mbar (0.022 psi) (relative)
Maximum pressure during operation:	18.0 mbar (0.26 psi) (relative)
Maximum bypass time:	Off

[1] Safety factor: 1.25
[2] Minimum primary pressure (longer purge time)

13 Appendix

13.1 Compliances

The technical design of this device complies with the following EU Directives:

- EMC Directive
- ATEX Directive

Applied EN standards:

- EN 61326: Electrical equipment for measurement, control and laboratory use, EMC requirements
- EN IEC 60079-0: Explosive atmospheres - Equipment - General requirements
- EN 60079-2: Equipment protection by pressurized enclosure ´p´
- EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements

Applied IEC standards:

- IEC 60079-0: Equipment - General requirements
- IEC 60079-2: Pressurized enclosure “p”
- IEC 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

Further standards and directives: see Declaration of Conformity delivered with the device

13.2 Ex approvals

ATEX

The MCS300P Ex meets the following qualifications in accordance with ATEX Directive 2014/34/EU:

- Ⓔx II 2G Ex eb pxb IIC T4 Gb *or*
- Ⓔx II 2G Ex eb pxb IIC T3 Gb

or

- Ⓔx II 3G Ex eb pzc IIC T4 Gc or
- Ⓔx II 3G Ex eb pzc IIC T3 Gc

IECEx

The MCS300P Ex meets the following qualifications in accordance with IECEx:

- Ex eb pxb IIC T4 Gb *or*
- Ex eb pxb IIC T3 Gb

or

- Ex eb pzc IIC T4 Gc *or*
- Ex eb pzc IIC T3 Gc

13.3 Certificates

EU Type Examination Certificate

- BVS 10 ATEX E 133 X
- BVS 10 ATEX E 134 X

IECEx Certificate

- IECEx BVS 17.0059X

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